West Valley Demonstration Project

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SYSTEMS DESCRIPTION

IN-CELL REMOTE HANDLING, MAINTENANCE, AND VIEWING

PREPARED BY _____ R. A. Meigs
Cognizant Engineer

APPROVED BY _____ R. A. Meigs
Cognizant System Engineer

APPROVED BY _____ D. K. Ploetz
Cognizant System Design Manager

APPROVED BY _____ W. L. Zuppinger
Quality Assurance Representative

West Valley Nuclear Services Co., Inc.
P.O. Box 191
West Valley, NY 14171-0191

WVNS RECORD OF REVISION

DOCUMENT

If there are changes to the controlled document, the revision number increases by one. Indicate changes by one of the following:

- Placing an arrow at the beginning of the sentence or paragraph that was revised
- Placing a vertical black line in the margin adjacent to sentence or paragraph that was revised
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Example:

The arrow in the margin indicates a change. >
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Rev. No.	Description of Changes	Revision On Page(s)	Dated
0	Original Issue	All	03/21/95
1	Per ECN #9066		06/30/95
	Corrected 3V-1 16 Ton Crane From 4 part reeving to 8 part	28	
	Corrected 15V-21 20 Ton Crane from A1 to A2 drive	31	
	15V-21 overloads affect both speeds	32	
	Added Drawing Reference 900D-6491	45	
	Added Clevis Lift Bail	49	
	Added Drawing to Reference Drawing List	72	
	Added New Test on Cart Performance	88	
2	Per ECN #9478		12/14/95
	Minor rewording	iv, 10, 18, 26, 28 29, 37, 42, 54, 55	
	Added mechanical overload to 63-M-001	10	
	Added drawing numbers	18, 44, 49, 73	

WVNS RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated
2 (cont)	Corrected door 63-M-002 speeds	20, 52	
	Added dual strike lamps	37, 38, 39	
	Added gasket removal tool	49	
	Added more description on door alarms	50, 51, 52, 54	
	Corrected door seal pressure	55	
	Deleted melter insert change-out test		

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SUMMARY

The In-Cell Remote Handling, Maintenance, and Viewing System is comprised of the transfer cart, cranes, manipulators, cameras, lighting, windows, shield door controls, and in-cell remote handling tools.

These components work in conjunction to support sampling activities and to transfer high level waste canisters to various locations in the Vitrification Cell, through the transfer tunnel, to High-Level Waste Interim Storage. (The facility for High-Level Waste Interim Storage is part of System 68 and will not be described herein.)

ACRONYMS AND ABBREVIATIONS

The acronyms and abbreviations listed below appear throughout the document.

CCR	Chemical Crane Room
CCTV	Closed Circuit Television
CFMT	Concentrator Feed Makeup Tank
CMR	Crane Maintenance Room
CMOA	Crane Maintenance Operating Aisle
COA	Chemical Operating Aisle
CPC	Chemical Process Cell
CTS	Component Test Stand
CVA	Chemical Viewing Aisle
DCS	Distributed Control System
EDR	Equipment Decontamination Room
EDRVA	Equipment Decontamination Room Viewing Aisle
EMOA	East Mechanical Operating Aisle
GPC	General Purpose Cell
HEME	High-Efficiency Mist Eliminator
HLWIS	High-Level Waste Interim Storage
HPS	High Pressure Sodium
ITMS	In-Cell Telerobotic Manipulator System
MFHT	Melter Feed Hold Tank
MSM	Master-Slave Manipulator
NAOA	North Analytical Operating Aisle
NFS	Nuclear Fuel Services
PaR	Programmed and Remote Electro-mechanical Manipulator (Model 3000)
PLC	Programmable Logic Controller

PPM	Parts Per Million
SBS	Submerged Bed Scrubber
SWL	Safe Working Load
UBC	Uniform Building Code
VC	Vitrification Cell
VF	Vitrification Facility
WTF	Waste Tank Farm

IN-CELL REMOTE HANDLING, MAINTENANCE, AND VIEWING

1.0 SYSTEM FUNCTIONS AND FUNCTIONAL DESIGN CRITERIA

1.1 Functions

The primary function of the In-Cell Remote Handling, Maintenance, and Viewing System is to provide remotely operated crane and cart handling of empty, filled, and completed (welded and decontaminated) vitrified HLW canisters within the Vitrification Facility. Secondary functions include:

- maintenance support for other in-cell systems
- remote handling of in-cell components
- viewing of in-cell components
- handling of samples
- operation of in-cell isolation valves
- change-out of "consumables" such as filters, thermocouples/thermowells, melter discharge lid heaters, filters
- operation of "C" sampler
- maintenance of the Remote Handling System itself.

1.1.1 Canister Movement

Several components work in conjunction to lift and transfer empty, filled, or partially filled canisters from one location to another, and securely hold canisters for cooling or temporary storage.

Moving canisters within the Vitrification Cell and to High-Level Waste Interim Storage is accomplished by cranes, grapples, transfer cart, and impact wrench. Viewing canister transfers is accomplished by the Closed Circuit Television System, shield windows, and in-cell lighting. Containing the cell and tunnel environment and permitting canister transfers between HVAC zones is accomplished by using door controls to open and close the shield doors. Holding canisters in empty, filled, or partially filled states is performed by the in-cell storage rack.

1.1.2 Equipment Movement

Several components work in conjunction to move equipment from one location to another.

Moving equipment within the Vitrification Cell and to High-Level Waste Interim Storage is accomplished by cranes, transfer cart, various fixtures, tooling and hooks, tipping assembly, and manipulators. Viewing equipment movement is accomplished by the Closed Circuit Television System, shield windows, and cell lighting. Permitting equipment transfers between HVAC zones is accomplished using door controls to open and close shield doors.

1.1.3 Sample Handling

Several components work in conjunction to support sample handling operations.

Moving samples to sampling stations and moving samplers to various locations is accomplished by cranes, grapples, and impact wrench. Enabling sampling operations are manipulators, grapple buckets, and various fixtures and tooling. Viewing sample handling operations is accomplished by the Closed Circuit Television System, shield windows, and cell lighting. Various tools also support sample capping and decontamination activities.

1.1.4 Maintenance Support

The following typical maintenance support activities are performed by the Remote Handling, Maintenance, and Viewing System.

- clean and cover PUREX nozzles
- detect radiation level of packaged waste in the EDR
- remove accumulated waste in the VF (Waste Handling Cans)
- change melter thermocouples and thermowells
- change discharge lid heaters.

1.1.5 Miscellaneous Functions

The system has to provide remote viewing capabilities as well as shielded viewing capabilities.

The system has to function in a radioactive environment.

The system has to support sampling operations.

The system has to remotely maintain and replace in-cell equipment.

The system has to remotely move empty canisters in the cell.

The system has to remotely move filled canisters out of the canister turntable and to various canister stations.

The system has to accommodate the movement of partially filled canisters to the in-cell storage rack or back to the turntable.

The system has to remove accumulated waste out of the Vitrification Facility to either the CPC (over 100 mr/hr) or to Lag Storage.

1.2 Functional Design Criteria

The In-Cell Remote Handling, Maintenance, and Viewing System shall meet the design requirements outlined in WVNS-DC-022, Vitrification of High-Level Wastes, and WVNS-DC-011, General CTS Component Design Criteria.

1.2.1 Design Criteria for Transfer Cart

Design requirements for the transfer cart are described in Appendix B of this document.

Fabrication requirements for the transfer cart can be found in WVNS-EQ-356, Fabrication of Vitrification Facility Transfer Cart System.

1.2.2 Design Criteria for In-Cell Canister Storage Rack

Design requirements for the In-Cell Storage Rack are described in Appendix C.

1.2.3 Design Requirements for the Facility MSMs

Design requirements for the facility manipulators are described in WVNS-EQ-307, Equipment Specification Vitrification Facility Master-Slave Manipulators.

1.2.4 Design Requirements for Impact Wrench

The impact wrench shall be capable of 500 rpm, 700 impacts per minute.

The impact wrench shall be capable of 450-550 ft. lbs. of torque applied to a nut in 10 seconds of impacting.

1.2.5 Design Requirements for Grapple

Design requirements for the canister grapple are described in WVNS-EQ-309, Equipment Specification Canister Grapple.

1.2.6 Design Requirements for Grapple Buckets

Grapple buckets shall be able to hold miscellaneous parts, tools, and supplies necessary to perform remote operations in the Vitrification Cell.

The buckets shall be capable of holding 100 lbs.

Grapple buckets are exempt from hoisting and rigging requirements. See section 2.5.1.A of this document for DOE Hoisting and Rigging Manual Exceptions.

1.2.7 Design Requirements for CCTV

Design requirements for the Vitrification Facility CCTV are described in WVNS-EQ-315, Equipment Specification Closed Circuit Television for Vitrification Process.

1.2.8 CPC Crane

Design requirements for the CPC crane can be found in WVNS-EQ-340, Chemical Process Cell 16/2 Ton Crane Modifications.

1.2.9 VF Process Crane and Backup Crane

Design requirements for the Vitrification Facility Process Crane and the Backup Crane can be found in WVNS-DC-032.

1.2.10 Shield Windows

Design requirements for the shield windows can be found in WVNS-EQ-308, Vitrification Facility Equipment Specification for Oil-Filled Shielded Viewing Windows.

1.2.11 Cell Lighting

Design requirements for the cell lighting can be found in WVNS-EQ-333, In-Cell Light Fixtures.

1.2.12 Miscellaneous Components

Fabrication, inspection, and testing for the tooling listed in section 2.3.7 can be found in WVNS-EQ-383, Fabrication of Miscellaneous Vitrification Components.

1.2.13 In-Cell Telerobotic Manipulator

Design criteria for the In-Cell Telerobotic Manipulator can be found in WVNS-DC-061.

1.2.14 Sample Handling

Sample handling will be performed using Master-Slave Manipulators and grapple buckets.

1.2.15 Process Support

The impact wrench will assist the off-gas system in switching HEME/Filter trains. Impact wrench operated valves are used to isolate the HEME/Filter trains. To switch from one train to the other, a total of four wrench operated valves must be operated. Operation of these valves is covered under System Description 63H, Off-Gas and Vessel Vent.

1.2.16 Remote Maintenance

Remote maintenance requirements for In-Cell Remote Handling, Maintenance, and Viewing are described in WVNS-DC-022, Design Criteria Vitrification of High-Level Wastes.

1.3 Process Requirements

None.

1.4 Structural Requirements

1.4.1 Cranes

Structural requirements and seismic criteria for the cranes are described in WVNS-EQ-230, Vitrification Facility Cell Equipment Specification, The Crane System.

1.4.2 Oil-Filled Shield Viewing Windows

Structural and seismic requirements for the shielded windows are described in WVNS-EQ-308, Vitrification Facility Equipment Specification for Oil-Filled Shielded Viewing Windows.

1.4.3 In-Cell Canister Storage Rack

Structural requirements for the In-Cell Canister Storage Rack are described in Appendix C.

1.4.4 In-Cell Lights

Lighting fixture mounting is designed to UBC Zone III with an Importance Factor of 1.5 and with the addition of a vertical acceleration equal to 2/3 of the horizontal component.

1.5 Essential Features

1.5.1 Remote Maintenance System

A. PUREX Connectors

Maintenance of most components In-Cell is aided by a jumper system which uses a 3-Jaw connector, called a PUREX connector. The jumper concept dates back to the 1940's, where it was used to support remote production of plutonium for the Manhattan Project. The original connector was designed by DuPont and was called the Hanford connector. In the 1950's, new production plants built by General Electric, used an improved, more compact design, which included a spherical seal face to improve the performance of the seal under conditions of poor alignment. The design of this connector survives to this day with back-ward compatibility. Jumpers built today will seal on connectors built 40 years ago. The PUREX design also introduced different sized connectors for different sized pipe and also included a specially designed electrical connector. The PUREX design was selected by Bechtel/NFS for use in the West Valley reprocessing plant and was also selected for use in the VF Cell and the Waste Tank Farm pump pits.

The 3-Jaw connector is operated using an electric impact wrench suspended from a crane hook. The wrench is based on the original 1952 designed with minor changes to accommodate facility specifics at West Valley. A longer socket has been selected for use at West Valley, to improve access to connectors in the CPC, and in some locations within the VF Cell. A "positioning" bar is provided to prevent wind-up when the wrench is used vertically. The bar slides up and down in a cage next to the socket. The bar engages with the yoke section of the PUREX connector so that the connector provides the small amount of force required to prevent rotation of the wrench. When the wrench is used horizontally, no such restraint is required, since the crane cables provide the restraint.

All connectors are provided with either a "kick" plate or an equivalent "kick" space. This is a 6.25 in. diameter circle for 2 in. and 2 in. 3-way, 11 in. diameter for 3 in. and 13 in. diameter for 4 in. nozzles. The kick space allows the three jaws to push off when disconnecting so that the seal adhesion forces are broken and to separate the seal faces as quickly as possible to protect them. The kick space also provides a "landing" spot for the connector or jumper, so that the seal faces are protected until the closure of the jaws draws the connector together correctly. Horizontal connectors include a catch built into the skirt which is used to "hang" the jumper on a horizontal nozzle, thus stabilizing the jumper while the impact wrench is being attached.

All connectors use a 2" hex, with a point on the end to aid in impact wrench alignment. Different threads are used on the different connectors to tailor the connector force to that required for a given connector size. Tests performed with the impact wrench on specially instrumented connectors, indicate that the compression loads attained inside the connector are significantly lower than would be expected for the amount of torque the impact wrench can provide. The apparent reason for this is flexing of the 3-Jaw mechanism. The impacts from the wrench will not transmit torque as efficiently as a rigid nut and bolt combination. Nominal impacting time for proper connector installation is 10 seconds of actual impacting.

Wetted parts in the connector are 304L stainless steel. The nozzle is cast CD4MCu which is a duplex stainless steel with very high yield and ultimate properties. Brittleness in nozzles is a concern, so special testing is performed on coupons from each batch to assure adequate performance. The remainder of the parts in the connector are various carbon steel alloys. Some connectors and nozzles have be fabricated from other materials such as Titanium for the decon system.

B. Three-Bolt Flanges

Maintenance of some components In-Cell is aided by jumpers which use a three-bolt flange system. This system is used for piping and ducting larger than 4 in. A lower flange, with three 1.25-8 ACME threaded studs is used to mate with an upper flange that has "nut cups" and "free nuts" to match the studs. A guide pin system is used to assure correct alignment of the flange prior to the studs engaging the free nuts. A gasket, appropriate for the temperatures and pressures involved, is

separately mounted between the two flanges. Once the upper assembly is completely in place, the free nuts will be resting at the tips of the studs, on the unthreaded portion in the nut. The impact wrench is then used to run the free nuts down and tighten the connection. Blunt start threads, formerly called Higbee cut threads must be used on all thread ends to ensure the nuts will engage without jamming or binding. Stops must be provided on the gasket retainer to prevent over-tightening and cocking of the jumper. In general, it is preferred that the nuts located towards the center of the jumper be tightened first.

Free nuts can be reused by placing them into the nut cups on a new assembly. This can be done using MSMs, or a handling tool on the impact wrench. Also, when a new assembly is being installed that must be tipped over, small cardboard wedges can be used to hold the free nuts into the nut cups. The cardboard will fall away when the studs push the free nuts up out of the nut cups.

Several different materials have been used for nuts and studs during the progression of component design. The material selections preferred by system 63K are 17-4 PH for studs, and Nitronic-60 for nuts. The thread surfaces should be finished to a 32 RMS and are to be coated with Pure Nickel Never Seize, Nuclear Grade. All replacement nuts shall be Nitronic, and Nitronic nuts are in warehouse max/min inventory. Components with nuts and studs of materials other than those preferred, are acceptable, provided the Blunt Start thread detailing is correct.

The three bolt flange concept has also been extended to connections with more than three bolts, such as agitator mounts, the central section of the Submerged Bed Scrubber (SBS), and the melter discharge lid heaters. The concept has also been applied to structural mounting of components where no gasket is used, such as the CFMT, SBS, HEME, and Condenser hold-down bolts.

When the impact wrench is operated on free nuts, the design torque value of the impact wrench of 450-550 Ft.Lb. is actually applied to the nut during the proper 10 second operating period.

C. Captured Bolt Connections

Captured bolt connections are used between parts of some components in the VF Cell. These connections are similar to a free nut/stud combination except that a bolt is used in the upper assembly and a threaded hole is used in the lower section. Captured bolts use either springs or wire brushes to hold the bolt clear of the connection during handling. The turntable, in-cell storage rack, transfer cart, and weld station take advantage of captured bolts for remote assembly.

D. Cams and Latches

Impact wrench operated cams and latches are used on the in-cell HVAC filter housings to retain the pre-filters and primary filters. Six cams are used on each filter housing to clamp the top section over the filters. A latch-actuator is used to push the pre-filter up against the inlet end of the filter housing. It is extremely important that the north east cam be unlatched before the pre-filter latch is opened or closed to avoid damage to the operating mechanism.

E. Jumper Bails

Each jumper is provided with a lifting bail, located above the center of gravity of the jumper. The jumper center of gravity, the jumper bail, and the two ends of the jumper must all be located roughly along a straight line in the X-Y plan. If the jumper is not built this way, then some additional means of support must be provided to assure the jumper is stable while attaching the impact wrench to the connector operating nut.

F. Double Lift Points

Larger components such as vessels are provided with two lift points for stable remote lifting. These lift points are either pins mounted between plates, or in the case of some lighter components, two round bent bars are provided.

G. Tipping Trunnions

Several components which are too tall to pass through the facility shield doors, have two tipping trunnions provided at the bottom so the equipment can be tipped using appropriate fixtures.

1.6 Maintenance and Inspection

Maintenance and inspection of components in this system are described in the individual equipment specifications. Additional requirements are described below.

1.6.1 Maintenance and Inspection of Transfer Cart

Maintenance and inspection of the transfer cart is described in Appendix B.

1.6.2 Remotely Operated Shield Doors

A. General Maintenance

Shield door drive mechanisms, limit switches, wheels, hinges, and hoist cables should be inspected and appropriate lubrications should be performed once per year.

B. Shield Door 63-M-001

> Door 63-M-001 has two ball nuts installed. One is attached and in use. The other is captured on the east side of the screw and is available for use in the event of a failure of the first nut. This allows nut replacement without having to move the entire ball screw into the tunnel area. There is also a recess in the west wall of the tunnel which allows the door to be pushed closed even if the ball screw extends beyond the end of the door. Set screws in the west bearings have been replaced with nylon tip screws to allow this.
> Door 63-M-001 has a mechanical overload coupling installed between the gearbox and the ball screw to prevent damage to the ball nut mount should the force required to move the door become excessive.

C. Shield Door 3M-3

Door 3M-3 has a mechanical overload coupling installed between the gearbox and the ball screw to prevent damage to the ball nut mount should the force required to move the door become excessive. There are also numerous extra limit switches installed should trouble be encountered with switches presently in use.

> D. Ventilation Door 63-M-008

Door 63-M-008 has a manned access scuttle for entry into the tunnel from EDR. The hatch is a 2 ft. by 2 ft. plate cover which can be unbolted.

1.6.3 Cranes

A. Cranes General

All cranes should be inspected yearly and load tested every three years in accordance with SOP-15-56.

Gearbox oil shall be changed in accordance with manufacturer's recommendations. Grease fittings shall be filled once per year with the same type of grease already in use. Mixing of different types or different manufacturer's shall be avoided to prevent separation of the lubricant and the carrier.

B. Vitrification Cranes

The major components on the Vitrification cranes can be replaced with the aid of the CMR crane. The cranes have platforms which allow maintenance with minimal requirements for scaffolding. The platforms will have to be monitored radiologically and decon/shielding used accordingly as they become contaminated.

C. CPC Cranes

The major components on the CPC cranes can be replaced with the aid of the one ton roustabout in the CCR. Scaffolding is used to maintained the CPC cranes, since no maintenance platforms are provided.

D. EDR Crane

The EDR crane is maintained using the Genie work platform that is located in the EDR. The 2-ton hoists on the CPC cranes can provide some limited support for handling of heavy components on the EDR crane via the EDR/CCR hatch.

1.6.4 Transfer Cart

A. On-Board Controller

The transfer cart on-board controller can be remotely replaced in the EDR with a complete stand-by controller that includes a set of batteries that are kept on a charge station in the EDR. Wheel assemblies and drive motor/gearboxes are maintained by manned entry into the EDR.

1.6.5 Lighting

A. Vitrification Cell

Vitrification Cell light fixtures can be remotely removed and replaced. The fixture includes a seismic latch that is activated by the lift bail. The light fixture can be moved to a work surface for lamp changes using manipulators.

B. CPC

CPC cell light fixtures can be remotely removed and replaced. The fixtures have a latch on the left side that must be opened by the PaR manipulator before removing the fixture with the PaR or a crane hook. The light fixture can be moved to a work surface in the Vitrification Cell for lamp changes using manipulators.

C. Tunnel

Tunnel lamps can be replaced by manned entry via the EDR using the Genie work platform from the EDR.

D. EDR

EDR lamps can be replaced by manned entry using the Genie work platform from the EDR.

E. CCR

CCR lamps can be replaced by manned entry.

F. CMR

CMR lamps can be replaced by manned entry.

1.6.6 CCTV Cameras

A. Vitrification Cell

Vitrification in-cell CCTV cameras can be remotely removed and replaced using the impact wrench to disconnect the electrical connector. The camera can be repaired on a work stand in the CMR.

B. Vitrification Crane

Vitrification crane CCTV cameras can be repaired in the CMR.

C. CPC

CPC cell CCTV camera can be remotely removed and carried to the CCR for repair. Enough cable is provided to reach the CCR.

D. Tunnel

Tunnel CCTV can be repaired by manned entry via EDR using the Genie work platform from EDR.

E. EDR

EDR CCTV camera can be repaired by manned entry using the Genie work platform from the EDR.

F. CCR

CCR CCTV camera can be repaired by manned entry.

G. CMR

CMR CCTV cameras can be repaired by manned entry.

1.6.7 Master Slave Manipulators

A. MSM General

MSMs can be repaired by removal and transport to the MSM shop. Manipulators are removed using overhead trollies on monorails in the ex-cell portion of the Vitrification Facility. Contamination control procedures will be required to assure safe removal of the manipulators. The manipulators are lowered down tc ground floor at the east roll-up door area and are transported to the MSM shop using fork trucks. The ex-cell handling system is part of System 63F.

1.6.8 Shield Windows

All VF shield window oil must be sampled on a yearly basis. The oil shall be analyzed for Neutralization number in accordance with ASTM-D974. Oil should be less than .008 KOH/g. Oil should be changed if it exceeds this value. Oil should also be changed if there is any cloudiness, or after a maximum of three years.

1.7 Instrumentation and Control

Components within system 63K are, for the most part, controlled by embedded control systems provided by the equipment providers. There are no DCS interfaces. Programmable Logic Controllers are used for the Transfer Cart, the CRT 16-ton crane, and for the CMR door 63-M-002. Hardware logic is used for the remainder of all cranes, manipulators, and shield doors. The CCTV system is the only component which is controllable from the VF Control Room. The control for the CCTV is personal computer based. The control system for the In-Cell Telemanipulator is personal computer based. Instrumentation and control of the transfer cart is described in Appendix B.

1.8 Interfacing Systems

The In-Cell Remote Handling, Maintenance, and Viewing System interfaces with the following systems:

System No.	System Name
63ED	VF Electrical Distribution
63F	Cell Walls and Ex-Cell Arrangement
63G	Waste Header
63H	Off-Gas
63I	Main Process
63IA	VF Instrument Air
63J	Canister Decontamination
63L	Canister Welding
63M	VF Load In - Load Out
67	HVAC
68	High Level Waste Interim Storage
69A	VF Sampling
69B	VF Sample Transfer

1.9 Quality Assurance

The Quality Assurance requirements for this system are in accordance with NQA-1 and the West Valley Nuclear Services Quality Assurance Program Plan. Specific quality assurance requirements for components in this system are contained in the relevant equipment specifications. Quality Assurance requirements for the transfer cart are described in Appendix B. Quality Assurance requirements for the In-Cell Canister Storage Rack are described in Appendix C.

1.10 Reliability Assurance

Equipment specifications require mechanical components to be tested for functionality at vendor shops.

Components in the system are designed with simplicity, redundancy, and ease of repair.

1.11 Safety Classes and Quality Levels

Safety Classes and Quality Levels are in accordance with the Quality Management Manual, Section 2, "Quality Assurance Program," Section 3, "Design Control," and are documented in WVDP-204.

Component	Safety Class	Quality Level
Transfer Cart	N	C
Canister Grapple	N	B
Cranes	N	B
Temp. Canister Covers	N	C
In-Cell Storage Rack	N	C
CCTV System	N	C
VF Shielded Viewing Windows	B	B
EDR, CCR, CPC Shielded Viewing Windows	B	B
In-Cell Lighting	N	C
Impact Wrench	N	C
Shield Doors	B	B
Master Slave Manipulators	N	C
Tooling	N	N

1.12 Codes and Standards

Codes and standards for the In-Cell Remote Handling, Maintenance, and Viewing System are described in the individual component or system equipment specifications. Codes and standards for the transfer cart are described in Appendix B. Codes and standards for the in-cell canister storage rack are described in Appendix C.

2.0 DESIGN DESCRIPTION

2.1 Functional Description

The Remote Handling System, System 63K, provides support to the primary process system for two operations, canister handling and sample handling.

These topics will be discussed in separate sections below.

2.1.1 Canister Handling

The components listed below are included in the Remote Handling System. This equipment will be used for routine canister handling. Functional descriptions are described in the following sections.

- Vitrification Process Crane
- Chemical Process Cell (CPC) 16-ton Crane
- Equipment Decontamination Room (EDR) 20-ton Bridge Crane
- Canister Grapple/Temporary Covers
- CCTV System
- Shielded Viewing Windows
- Transfer Cart
- Vitrification Facility Shield Doors
- In-Cell Lighting
- Impact Wrench
- In-Cell Storage Rack.

A. Cranes

1) Process Crane

The Vitrification process crane is used to handle canisters throughout the Vitrification Cell. Full canister handling is a high-level waste activity in accordance with EP-2-001. The process crane is a twin 4.5 ton hoist/trolley mounted on a bridge. The twin hoists are mounted 32-inches from each other on a turntable which allows the hoists to rotate 359 degrees. This allows the hoists to reach closer to the Vitrification cell walls than would be possible with only a single hoist and also makes load orientation possible. In its

normal configuration, the process crane will have a canister grapple and an impact wrench linked directly to the load blocks to avoid the possibility of inadvertent dropping from a hook. A master-slave manipulator operated release mechanism is included to allow removal of the link and grapple.

2) Back-up Crane

A back-up crane is also provided which has a bridge identical to the process crane. The hoist/trolley on the back-up bridge is 25-ton capacity. This capacity is only required for major equipment change-outs, or final decommissioning. The back-up crane will normally be stored in the Crane Maintenance Room (CMR) on the same runway as the process crane.

A failed hoist recovery module is also available for use in the event of a failure of the process crane. The failed hoist recovery module can be bolted to the trolley on the backup crane in the CMR and used to lower loads stranded on the process crane. The crane can also be pulled back to the CMR for repair by towing latches on the back-up crane, in the event of a bridge drive failure.

3) CPC Crane

The CPC 16-ton crane is used to remove canisters from the transfer cart and place them into the interim storage racks. Full canister handling is a high-level waste activity in accordance with EP-2-001.

To overcome the event of total crane cable reel failure or hoist motor/mechanical failure, a secondary "load lowering device" is mounted between the 16-ton hoist and the grapple. This allows the power manipulator bridge to be used to lower a canister to allow bridge retrieval.

4) EDR Crane

The EDR 20-ton crane is used to load empty canisters into the transfer cart. The crane has two 10-ton hoist/trolleys mounted on a common set of girders.

B. Canister Grapple/Temporary Covers

The canister grapple is a gravity actuated indexing mechanism which requires two complete set-down cycles to disengage the three lifting hooks. The design capacity of the grapple is over twice the maximum filled canister weight. An indicating system is provided on the grapple to give the operator status on the indexing mechanism. A master-slave manipulator operated release mechanism is included to allow canister removal should the grapple indexing mechanism fail. The grapple also serves as a temporary cover during handling to keep foreign material out of the canisters. Operation of the grapple is a high-level waste activity in accordance with EP-2-001.

> Temporary covers, Drawing 900D-5042, will be used for prolonged storage of canisters within the Vitrification Cell. The design of the cover allows the grapple to handle canisters with the cover in place. The 2" socket on the impact wrench in conjunction with the impact wrench lifting adapter will be used to remove and carry the temporary covers as required. No other use of the impact wrench is required for canister handling. Temporary covers will be reused by transferring back to the EDR on the lid handling fixture attached to the transfer cart. Operation of the temporary cover is a high-level waste activity in accordance with EP-2-001.

C. CCTV

Six Closed Circuit Television cameras (CCTV) are located in the Vitrification Cell to aid in viewing. The Vitrification process crane also has five video cameras. One CCTV camera is located in the transfer tunnel, two are mounted on the EDR bridge crane, one mounted on the Chemical Crane Room (CCR) platform, one on the CPC wall, and one mounted on the 16-ton trolley/hoist in CPC. Each crane control station will have controls for the video cameras and monitors so that auxiliary views of canister handling operations may be used.

D. Viewing Windows

The Vitrification Cell has six oil-filled lead glass viewing windows for shielded viewing of remote operations. The CMR also has an oil-filled lead glass viewing window to observe the cranes as they are being moved into the CMR and to monitor contact maintenance operations in the CMR. The CPC has four original oil-filled lead glass viewing windows. The CCR and the EDR have Zinc-Bromide windows that have been converted to oil

filled windows to provide observation of contact maintenance operations in these rooms.

E. Transfer Cart

A battery powered, radio controlled transfer cart will be used to move empty canisters into Vitrification from the EDR load-in facility and to move filled canisters to the CPC. The cart can be controlled from either the north viewing window of the Vitrification cell or the north window of the CPC. The transfer cart is normally stored at the battery charging station which is located in a low radiation area in the EDR to maintain a low total integrated dose to the cart control system. Four antennas are located in the Vitrification facility to assure line-of-site control transmission at all times. The cart has two antennas with a diversity detection system which will continually check signal strength and use the antenna with the highest signal strength. The dual antennas will assure continuous control even if signal nulls should occur due to multi-path reception from signals bouncing off of stainless steel liners within Vitrification.

The transfer cart has four completely independent drive trains, any one of which is sufficient to drive the cart. The cart travels at approximately 15 feet per minute. The control/battery enclosure can be replaced with a spare from the EDR using an overhead crane. In the event of a total cart failure, a previously existing tethered cart is available in the EDR for pushing or retrieving the failed cart. A removable canister rack holds four canisters in the center of the cart approximately 4 inches above the transfer cart rails.

The Transfer Cart System provides as its prime activity for the transfer of filled or unfilled canisters between the VC, the EDR, and the CPC. The secondary activity is to provide the base platform and locomotion means to transfer materials to and from the areas served by the existing rail system within the Vitrification Facility.

F. Shield Doors

The Vitrification Facility shield doors are operated from control stations at the north viewing window of Vitrification or the north window of the CPC. There are three tunnel doors. A 13-inch thick steel shield door between the Vitrification Cell and the tunnel which opens to the east. The door is driven by a 2.5" dia. ball screw at 1.4 fpm. Full travel time is 9.6 minutes.

A two-inch thick steel, twin leaf ventilation control door is located between the EDR and the tunnel. This door swings open to the north in approximately 2.5 (per leaf) minutes using two linear actuators.

A four-foot thick concrete filled shield door opens to the west between the EDR and the CPC. The door is driven by a 1.5" dia. ball screw a ? fpm. Full travel time is 5.75 minutes.

An additional vertical lift, 9-inch thick steel shield door is located between the CMR and the Vitrification Cell to allow contact maintenance of the Vitrification Cell cranes. This door is lifted by twin 52-ton hoists at a travel rate of 8/0.8 fpm for an opening time of 1.7/17 minutes. Note that the slow speed should not be operated for more than 3 minutes at a time, within a 10 minute period.

The shield doors along the transfer cart rails are interlocked with the transfer cart control system software to assure that doors are not operated when the transfer cart is moving and that the transfer cart cannot be moved when doors are moving. In addition, the cart controller will only allow one door to be open (ie. fully closed limit switch not tripped) at a time. This interlock can be overridden at the cart engineering station at the EDR viewing window in the event that more than one door needs to be opened to support a special remote operation such as cart retrieval.

The CCR shield door is a vertical lift, three-foot thick, concrete filled door. The door is raised by twin 75-ton hoist drums driven from a common motor/gearbox at 2.5 fpm. Travel time is 6.4 minutes. The door is controlled from the CCR viewing window.

G. Lighting

The Vitrification Cell is illuminated with 32 high pressure sodium (HPS) lamps, 400 watts each with ballasts located in the operating aisle. These light fixtures are remotely replaceable using the process crane. The process crane also has six HPS lights with ballasts built into the fixtures. The VC lighting was designed to assure 50 footcandles effective lighting at all work stations. Due to the significant transmission loss of light through lead glass shielding in the shield windows, actual in-cell lighting levels are over 200 footcandles to assure an effective 50 footcandles through the windows. The CCTV system will operate effectively at significantly lower light levels, but will not be

adversely affected by the higher light levels being provided. The tunnel is illuminated with six HPS 100 watt fixtures for a lighting level of less than ten footcandles which is sufficient for CCTV viewing. There is no direct shield window viewing into the tunnel.

The CPC crane lighting and EDR lighting was originally self ballasted mercury vapor high-bay type lights. These lights have all been replaced with HPS fixtures of the same type as the process crane fixtures, however the voltage is 480 rather than 208. The CPC in-cell lighting was originally 14 remotely changeable 1000 watt mercury lamps with ballasts outside of the CPC. Seven of these lights have been replaced with new fixtures with 1000 watt HPS lamps and new HPS ballasts located outside of the CPC. Since no remote operations are possible in the CPC without the cranes in the cell, most of the lighting is from a single row of eight HPS fixtures on the 16-ton bridge crane and from a single row of six HPS fixtures on the two-ton/power manipulator bridge. The in-cell 1000 HPS lights will be sufficient for CCTV monitoring and general viewing without the cranes in the CPC.

2.1.2 Sample Handling

The following table lists the equipment included in the Remote Handling System which will be used to support routine sampling operations.

- Vitrification Process Crane
- Canister Grapple
- Impact Wrench
- CCTV System
- Shielded Viewing Windows
- In-Cell Lighting
- Master Slave Manipulators (MSMs)
- Grapple Handled Buckets.

MSMs will be used for all sample bottle handling in the Vitrification Cell. The following table lists the four types of sampling operations that will be performed.

- Feed Slurry Sampling
- "C" Sampler Solution Sampling
- Glass Shard Sampling
- Canister Decon Smear Surveys
- Glass Sampling from the Melter Pool.

A. Feed Slurry Sampling

Except for Smear Surveys, all samples will be handled in the same glass bottle type. The bottles are 10 ml nominal, rectangular sided, with a rounded bottom interior to aid in slurry removal. Several different caps will be used.

Bottles are transferred into the Vitrification Cell at the sample station at the north west shield window using a shielded transfer drawer. Model "F" MSMs will be used to take the bottles out of the transfer drawer and place them into the slurry sampler. The MSMs are also used to handle valves on the sampler during sampling. After sampling, the sampling cap is replaced with a solid cap to assure spill free, safe transfer through the SGN pneumatic transfer system to the Analytical Chemistry Labs. The bottles will be decontaminated at the sample station by placing them into an ultrasonic bath. After decon, the MSM is used to place the bottle into a gravity transfer tube to the shielded sample transfer cell where it is caught in a "rabbit." Rabbits are plastic capsules used in the SGN system to contain the bottles. Model G-HD MSMs are used in the shielded sample transfer cell to place rabbits into the bottle receiver and to removed filled rabbits from the receiver. Once the filled rabbit is removed from the receiver, it is capped and either sent to the analytical labs through the SGN "sender unit," or stored in a shield slot for later transfer.

Used sampling bottle caps will be decontaminated periodically in the ultrasonic bath and disposed of as low level waste using waste handling cans.

B. "C" Sampler

The "C" Solution Sampler is a portable sampling fixture that is used on the Submerged Bed Scrubber and the Canister Decontamination Station to obtain low suspended solids samples. Sample bottles are placed in the portable sampler, and the process crane is used to move the sampler to its mounting nozzle on the equipment to be sampled. Once the sampler is in place in the correct orientation, the impact wrench is used to tighten a PUREX connector on the sampler to seal the sampling lines. The equipment being sampled has all utility provisions required to obtain a flow-through sample in the bottle. Once the sample is obtained, the impact wrench is used to loosen the PUREX connector and the process crane moves the sampler back to the sample station. The bottle is removed from the sampler using MSM's and is handled similar to a slurry sample.

C. Glass Shard Sampling

Glass shard sampling is performed at the Canister Welding Station. Bottles are transferred in using a transfer drawer at the weld station. Samples are obtained from the canister using an MSM handled vacuum wand. After collecting glass shards on a screen in the vacuum wand, the vacuum is shut off and the shards are allowed to drop into a funnel, which directs the shards into a bottle below. Excess glass shards are returned to the canister by tipping the tray using the MSM. Some glass shards are sent to the analytical labs for testing while other samples are retained as an archive. The glass shards to be sent to the analytical labs must be moved to the sample station using the process crane and canister grapple in grapple handled buckets. These buckets will also be used for storage and transport of miscellaneous tools and parts required to support all in-cell remote maintenance operations. Samples being retained for repository use can be periodically transferred to the CPC for storage in the HLWIS using a sample storage fixture.

D. Smear Surveys

Decontaminated Canister Smear Surveys are transferred into the decon station using the transfer drawer at the decon station. The smear taking fixture is removed from the transfer drawer using the MSM. As the process crane removes the canister from the decon station, smears are taken at various locations on the canister. After each smear is taken, the smear end is detached from the fixture and dropped into the transfer drawer. The smear is then removed to the ex-cell glove-box on the transfer drawer where it is bagged out and counted for Alpha and Beta/Gamma contamination by Radiation and Safety.

E. Melter Glass Sampler

A means of sampling the glass melt pool in the melter is needed to verify glass chemistry prior to restart of a melter which has been idle for a period of time and may have reduced the concentration of the more volatile components. A remote handled rod dipped into the glass will retain enough glass for a sample.

2.2 Physical Description

The In-Cell Remote Handling, Maintenance, and Viewing System operates and is located in the Vitrification Cell, Transfer Tunnel, and High-Level Waste Interim Storage. The system is comprised of cranes, hoists, a transfer cart, lights, cameras, shield windows, door controls, manipulators, and assorted remote handling tools. These will be described individually below.

2.3 Component Descriptions

2.3.1 Cranes

Refer to drawings 900D-1759 and 900D-1760 for general arrangements of the cranes in System 63K.

A. VF Cell Cranes, 63-W-050 and 63-W-051

The process crane is a twin 4.5-ton hoist/trolley mounted on a bridge. The twin hoists are mounted 32-inches from each other on a turntable which allows the hoists to rotate 359 degrees. This allows the hoists to reach closer to the Vitrification Cell walls than would be possible with only a single hoist and also makes load orientation possible. In its normal configuration, the process crane will have a canister grapple and an impact wrench linked directly to the load blocks to avoid the possibility of inadvertent dropping from a hook. A MSM operated release mechanism is included to allow removal of the link and grapple.

A back-up crane is also provided which has a bridge identical to the process crane. The hoist/trolley on the back-up bridge is 25-ton capacity. This capacity is only required for major equipment change-outs, or final decommissioning. The back-up crane will normally be stored in the Crane Maintenance Room (CMR) on the same runway as the process crane.

A failed hoist recovery module is also available for use in the event of a failure of the process crane. The failed hoist recovery module can be bolted on the trolley on the back-up bridge and used to lower loads stranded on the process crane. A counter weight must be used on the hook to prevent tipping of the trolley when using the recovery module. The crane can also be pulled back to the CMR for repair by towing latches on the back-up crane in the event of a bridge drive failure.

Bridge and trolley drives have rubber cushioned shaft-48 mounted gearboxes to further reduce shock loading. Bridge drive is a CMAA70 type A4, with two totally independent drives and no cross shaft between them. This configuration has been tested to demonstrate straight tracking even with one failed drive.

> All motions on the cranes are two speed and are relatively slow compared to nonremote cranes to reduce the possibility of lifting mishaps. Bridges travel north-south at 12/4 ft. per minute, trolleys travel east-west at 12/4 ft. per minute, the 25-ton hoist lift rate is 6/2 ft. per minute and the process hoists are 15/5 ft. per minute. The process hoist trolley rotates at 1.5/0.5 revolutions per minute. The process hoists lift 48 feet 4 inches to elevation 134 ft. 1-5/8 in. and the 25-ton hoist lifts 45 feet 6 inches to elevation 131 ft. 6-7/8 in. The bridge span is 36 feet 3 inches and the trolley spans are 4 feet 6 inches. All hoists include a geared-up limit, geared-down limit, a final block actuated trip, and an overload limit switch.

The load blocks allow for either free swiveling, or locking the hook/clevis in 90° increments. The lock is operated either manually or by MSM.

Both the 4.5-ton and 25-ton hoists have four part double reeving with straight lift capability.

New/replacement crane components can be moved into the CMR using the CMR Operating Aisle or via the CMR roof hatches.

The control system for the cranes actually includes two independent, redundant control systems designated System 1 and System 2. Both systems can control either bridge with both process and 25-ton trollies mounted on either end of the bridge at the same time. Power and control is provided by cable carriers for both the bridge and the trollies. The cable carriers provide all connections to operate any trolley at any location on any bridge using any control system. In order to allow this versatility, cable carriers originate in the middle of each trolley-way, and allow feeding of the trolley from either the east or the west. Normally one of the cable carriers is not in use and must be secured. Extra cables in an active cable carrier provided for the trolley which is not in use must also be secured to prevent damage to the connector ends.

Portable operator control stations may be located through-out Vitrification at various shielded viewing windows. Two large consoles provide control for all crane functions including the recovery module. These consoles must never be plugged into the same system number at the same time to avoid damage and unpredictable control. Two smaller controllers, called "boxes," provide control of the normal operations of ON/OFF, Hoist, Trolley, and Bridge.

> Secondary travel limit switches are provided for all hoist up motions and for all trolley east/west limits. These extra limits are intended to decrease the likelihood of snagging a load on the bridge girders, or of damaging the runway cable carrier. When these limits are tripped, a key can be obtained from the Shift Supervisor which will allow overriding these secondary limits and proceeding to the final limit for hoists or hard stop for trollies. When raising a load to the secondary up limit, rotation of the two process hoists to their east/west positions is advisable to assure clearance with the bridge girders. This will be required to pass loads between CMR and the VC. When operating in this override mode, only slow speeds are available on all motions. Should a motion failure occur during this time period, some hardwired jumpering may be needed to allow use of high speed for recovery.

> The control system provides solid state "soft-start" for bridge and trolley motions. These circuits reduce motor heating, wire heating, arcing on contactors, and also provide some shock reduction to motors and gearboxes. The circuits function by limiting the inrush current and can be adjusted for various ramp rates. The bridge drive circuitry includes detectors which will trip out low or high speed based on low current to one of the two bridge drive motors. This feature was provided to minimize "crabbing" of the bridge should one motor or power/control system fail. Only the speed in operation during the low current trip will be shut down. A switch on the doors of the system power center is used to reactivate the drive should it trip out.

Thermal overloads are provided in the power center for all speeds on all motions. These overloads affect only one speed (but both directions) and are manually reset in the power center in the CMOA.

All motions on the crane are provided with electro-mechanical brakes. When power is applied to the brake, the brake disengages allowing motion. Except for the bridge brakes, all brakes are automatically operated by the motion joy-stick. The bridge brake allows for several modes of operation. There are AUTO/MANUAL and ON/OFF switches. The AUTO setting controls the brake automatically like the other motions regardless of ON/OFF setting. In the MANUAL mode, the brakes will response only to the ON/OFF button. When set to MANUAL plus OFF the bridge will coast a slight distance. When set to MANUAL plus ON the bridge will run against its brake. This setting is intended to provide additional positioning accuracy. This setting should not be used unless absolutely necessary due to obvious increased loads to both the motor and the brake.

Refer to Kranco drawing series 9985- for crane details.

B CMR Crane and Transfer Hoists

A 10-ton bridge crane is located in the CMR on a runway above the VF Cell cranes. This bridge is used to support maintenance of the VF Cell cranes, such as trolley swapping or motor/gearbox replacements. The crane is operated by pendants either in the CMR or in the CMOA. Some remote operation of this crane within the CMR is possible. The hook is free swiveling. The hoist has four part single reeving, but does not provide straight lift capability.

The CMR bridge travels north-south at 18/6 ft. per minute with a total runway length of approximately 32 ft. Bridge drive is a CMAA70 type A4, with two totally independent drives and no cross shaft between them. The trolley travels east-west at 15/5 ft. per minute. The hoist lift rate is 11/4 ft. per minute. The hoist lifts 50 ft. to elevation 141 ft. 4 in. The bridge span is 36 ft. 3 in. and the trolley span is 6 ft. This crane was provided by section 14320 of WVNS-CS-134.

Two 14-ton fixed hoists are located in the CMR roof, one at the east and one at the west crane runway of the VF cranes. The hoist lift rate is 13/4/.65 feet per minute. The hoist lifts 26 ft. to elevation 143. The limit switch limits down motion to 14 ft. to avoid slack cables. These hoists are used in conjunction with bridge transfer lift beams to swap which bridge is north and which is south. Manned entry into the CMR is required to perform this operation. The hooks are free swiveling.

The hoists have four part single reeving and provide straight lift capability. These hoists were provided by section 14340 of WVNS-CS-139. The hoists are provided with geared-up and geared-down limits.

Repair access is via the metal enclosures on the CMR roof.

C. CPC 16-ton Crane, 3V-1

The CPC 16-ton crane is an original crane provided by Bechtel from Programmed and Remote Systems (PaR), and has been extensively upgraded. The 2-ton hoist was replaced in 1984 as were the 16-ton hoist and trolley. The bridge drive, control system, electrical distribution, and cable reel are new as of 1994. Bridge drive is a CMAA70 type A4, with two totally independent drives and no cross shaft between them. The crane has a 16-ton trolley/hoist on the south girders and a 2-ton auxiliary hoist on the north girders.

The north-south bridge travel is 9.5/3.2 feet per minute. The bridge span is 25 feet 6-3/4 inches. Total travel is approximately 120 ft. There is no bridge brake.

> The 16-ton hoist lifts at 6/2 feet per minute. The hoist lift is 39 feet 0 inches to an elevation of 138 ft. 9 in. The hook is free swiveling. The hoist has a geared-up, geared-down limit switch. The hoist has eight part reeving and provides straight lift capability.

The 16-ton trolley travels east-west at 9/3 feet per minute. Total travel is approximately 19 ft. The 16-ton trolley span is 4 feet 8 inches. The trolley has an automatic brake.

The 2-ton hoist lifts at 21/7 feet per minute. The hoist lift is 65 feet 0 inches to an elevation of 140 ft 6 in. The hoist has a geared-up and geared-down limit. The limit switch has been adjusted to limit the travel to approximately 40 ft., since lifts into the GPC (below CPC) are no longer required. The 2-ton trolley span is 32 in. The hook is free swiveling. The hoist has two part reeving and provides straight lift capability.

The 2-ton trolley travels east-west at 18/9 feet per minute. Total travel is approximately 21 ft 6 in. The 2-ton trolley span is 32 in. There is no trolley brake.

The crane is controlled by a portable control station from any of the CPC windows or from the CCR window. Main power and control is provided by a cable reel mounted on the northwest corner of the bridge. The cable lays behind the runway track. Power and control to the trollies is provided by festoons on a messenger wire. The control system is a multiplexed system with motor contactors mounted on the bridge. Redundant PLC I/O racks are mounted above shielding blocks to increase reliability. The 16-ton hoist has redundant wiring which by-passes the entire control system and allows lowering of loads in the event of a control system failure. Lighting power is from lighting panel E, independent of the crane power to increase lamp life.

To overcome the event of total crane cable reel failure or hoist motor/ mechanical failure, a secondary "Load Lowering Device" is mounted between the 16-ton hoist and the grapple. This allows the power manipulator bridge to be used to lower a canister to allow bridge retrieval. A towing mechanism is installed on the manipulator bridge so that a towing cable from a winch mounted on the CCR platform can be connected to the 16-ton bridge. The bridge can thus be pulled back to CCR for repair behind the CCR/CPC shield door.

New/replacement parts are moved into the CCR via the CCR air-lock, EDR to CCR through the hatch, EDR to CPC to CCR using the transfer cart, or through the hatch covers in the CCR roof.

> The two-ton hooks can be lowered in the EDR through a 24 in. by 56 in. hatch to transfer small loads between the EDR and CCR.

Thermal overloads are provided in the motor control center for all speeds on all motions. These overloads affect only one speed (but both directions) and are manually reset in the motor control center. Since the motor control center is located on the bridge crane, a manned entry will be required to reset a tripped unit. The decision to use non-self-resetting overloads was a conscious one to assure control over nuisance tripping and to maintain reliable two-speed redundancy. The crane should not be used for canister handling if one speed is not available for redundancy.

Refer to drawing 900D-5244 for the CPC 16-ton crane drawing list.

D. CPC 2-Ton/Manipulator Crane 3V-2

The CPC 2-Ton crane/manipulator is an original crane provided by Bechtel from Programmed and Remote Systems (PaR), and has been extensively upgraded. The 2-ton hoist was replaced in 1984. The power manipulator hoist, trolley, tubes, control system, and cable reel were replaced in 1993. The shoulder/arm assembly was replaced in 1986. The bridge drive will be replaced in 1995 as will the manipulator trolley girders, both changes intended to prevent oscillation during manipulator operation. Festoons were replaced in 1984. Bridge drive is a CMAA70 type A4, with two totally independent drives and no cross shaft between them. The crane has a 2-ton trolley/hoist on the north girders and a power manipulator on the south girders.

The north-south bridge travel is variable speed 2.2 to 22 feet per minute. The bridge span is 23 ft. 11 in. Total travel is approximately 120 ft. There is no mechanical brake, but dynamic braking is used.

The manipulator hoist lifts at 1.5 to 13.7 feet per minute. The hoist lift is 27 feet to an elevation of 127 ft. 8 in. The capacity of the hoist is 1000 Lb. with the shoulder/arm in place. The hoist uses a regenerative DC drive to control load lowering and has an electro-mechanical brake to hold the load when stopped. The tubes have a cam driven up and down limit, a secondary cam driven up limit, and a slack cable limit. The capacity of the arm is 150 Lb.

The manipulator trolley travels east-west at 1.5 to 15 feet per minute. Total travel is approximately 16 ft. The manipulator trolley span is 28 inches. There is no trolley brake.

The two-ton hoist lifts at 21/7 feet per minute. The hoist lift is 65 feet 0 inches to an elevation of 135 ft. The hoist has a geared-up and down limit. The limit switch has been adjusted to limit the travel to 33 ft., since lifts into the GPC (below the CPC) are no longer required. The hook is free swiveling. The hoist has two part double reeving and provides straight lift capability.

The two-ton trolley travels east-west at 18/9 feet per minute. Total travel is approximately 20 ft. The 2-ton trolley span is 32 in. There is no trolley brake.

The crane is controlled by a portable control station from any of the CPC windows or from the CCR window. Main power and control is provided by a cable reel mounted on the northwest corner of the bridge. The cable lays behind the runway track. Power and control to the trollies is provided by festoons on a messenger wire. The control system has individual conductors for every motion with motor contactors and DC power supplies mounted in the ex-cell power center. A 2-ton power and tool power (impact wrench) are 480 volt 3 phase while all other motions are variable speed DC. Lighting power is from a lighting panel, independent of the crane power to increase lamp life.

Either the 2-ton hook or the manipulator can be lowered into the EDR through a 24 in. by 56 in. hatch for repair or to transfer small loads between the EDR and CCR.

Thermal overloads are provided in the power center for all speeds on all motions. These overloads affect only one speed (but both directions) and are manually reset in the power center in the EDRVA.

Refer to PaR vendor drawings for manipulator details.

E. EDR Cranes, 15V-21

The EDR crane has two 10-ton hoist trolleys mounted on a common set of girders. The bridge travel is east-west at 12/4 feet per minute with a total travel of 33 ft. 9 in. Bridge drive is a CMAA70 type A2, with a cross shaft between them. The bridge span is 30 feet 8 inches.

The 10-ton trolleys travel north-south at 9/3 feet per minute with a total travel of 23 ft. 8 in. The trolley span is 5 feet 0 inches. The hooks are 5 ft. 2 in. apart with the trollies contacting each other.

The hoists lift at 6/2 feet per minute. The hoist lift is 37 feet 0 inches to elevation 121 ft. 11-1/2 in. The hooks are capable of reaching the bottom of the soaking pit, however, since the soaking pit is covered, this operation is not required. The hoists have a block activated up limit only. The hooks are free swiveling. The hoists have eight part double reeving and provide straight lift capability.

Hooks, load blocks, and hoist cables are all new as of 1993. The crane is controlled by a control pendant at the EDR window. The pendant is new as of 1994 and includes control of the new EDR impact wrench. All power and control is supplied by festoons throughout. The contactors are outside of the EDR in the EDR viewing aisle. All motions use electro-mechanical brakes.

Thermal overloads are provided in the power center for all speeds on all motions. These overloads affect both speed and are manually reset in the power center in the EDRVA.

Refer to drawings 3B-P-1056, series VP-4413-15-V-77-, and 900D-5664.

2.3.2 Transfer Cart, 63K-V-055

A battery powered, radio controlled transfer cart will be used to move empty canisters into Vitrification from the EDR Load-In facility and to move filled canisters to the CPC. The cart can be controlled from either the north viewing window of the Vitrification Cell or the north window of the CPC. The transfer cart is normally stored at the battery charging station which is located in a low radiation area in the EDR to maintain a low total integrated dose to the cart control system. Four antennas are located in the Vitrification Facility to assure line-of-site control transmission at all times. The cart has two antennas with a diversity detection system which will continually check signal strength and use the antenna with the highest signal strength. The dual antennas will assure continuous control even if signal nulls should occur due to multi-path reception from bouncing on stainless steel liners within Vitrification.

The transfer cart has four completely independent drive trains, any one of which is sufficient to drive the cart. The cart has no electro-mechanical brake, but dynamic braking is performed for a one second period upon loss of drive request. The cart travels at approximately 15 feet per minute. The control/battery enclosure can be replaced with a spare from the EDR using an overhead crane. In the event of a total cart failure, a previously existing tethered cart is available in the EDR for pushing or retrieving the failed cart. A removable canister rack holds four canisters in the center of the cart approximately 4 inches above the transfer cart rails.

Numerous additional fixtures are available for use with the transfer cart. See tooling section for details. See ORNL-TM64350 for additional information on the transfer cart control system.

The shield doors along the transfer cart rails are interlocked with the transfer cart control system software to assure that doors are not operated when the transfer cart is moving and that the transfer cart cannot be moved when the doors are moving. In addition, the cart controller will only allow one door to be open (ie. fully closed limit switch not tripped) at a time. This interlock can be overridden at the cart engineering station at the EDR viewing window in the event that more than one door needs to be opened to support a special remote operation such as cart retrieval.

See drawings 900D-4862 to 900D-4871 and ORNL drawing series X3E020097A- and Q-6340- for cart design details.

2.3.3 Master Slave Manipulators

Master Slave Manipulators (MSMs) use a series of cables, rods, and stainless steel tapes to transmit motions through the shield walls in a 1 to 1 correlation. Motions include X, Y, Z, elevation rotation, twist rotation, azimuth rotation, and grip. All master and slave components are counter-weighted such that the operator does not have to lift the weight of the manipulator. The effect of inertia, however, is not eliminated, thus, operation of an MSM for a prolonged period is quite fatiguing to the operator. Absolute maximum capacity is 100 Lb., although the practical limit is more like 20 Lb.

To provide better comfort to the operator, the X, Y, and Z motions are provided with an electric motor assisted indexing capability to allow a normal operator working position while the slave end is offset with the 10 foot radius spherical quadrant around the manipulator port.

The tong motion provides two modes, either 1 to 1 or progressive ratcheting. In either motion there is a two speed, automatic shift from low force/higher speed to high force/lower speed. Grip overload warning is provided since grip tape failure is the most common failure mode.

MSMs may be removed from the shield wall and transferred to the MSM repair shop using the monorail/hoist system in the ex-cell aisles. The tongs must be removed from the grip prior to removal and the contamination control boot remains in the hole while the manipulator is removed into a bag or a tent. Total weight of a VF Cell manipulator is approximately 1500 Lb.

The Sample Transfer Cell uses a smaller version of the MSM which weighs 300 LB and does not include Z motion indexing since it has a 4:3 motion ratio in the Z direction. Absolute maximum capacity is 18 Lb., although the practical limit is more like 10 Lb.

Through-tube shielding and airflow restriction is provided. MSMs operate on 120VAC, 15 Amp.

Refer to maintenance manual for MSM information. No drawings are available.

2.3.4 Radiation Shielding Windows

A. Type I Shield Windows, 63-F-M-1E01, 5E01, 3E01, 9E01, 9E02

The Vitrification Cell has five oil-filled lead glass type I viewing windows for shielded viewing of remote operations. These windows are horizontally placed with a clear view of 40 in. wide by 22 in. high. The normal viewing angle is 33° horizontal by 6° up/35° down and extreme viewing angle is 80° horizontal by 68° vertical. The hot side oil gasket is located on the cold side of first piece of glass to shield it for a lower total integrated radiation dose. A separate hot side protective barrier is used to allow removal of the shield window without breaching the cell containment.

B. Type II Shield Window, 63-F-M-1G01

The Vitrification Cell has one oil-filled lead glass type II viewing window for shielded viewing of remote operations at the melter. This window is vertically placed with a clear view of 22 in. wide by 40 in. high. The normal viewing angle is 21° horizontal by 20° up/45° down and extreme viewing angle is 68° horizontal by 80° vertical. The hot side oil gasket is located on the cold side of first piece of glass to shield it for a lower total integrated radiation dose. A separate hot side protective barrier is used to allow removal of the shield window without breaching the cell containment.

C. Type III Shield Window, 63-F-M-11E01

The CMR has one oil-filled lead glass type III viewing window for shielded viewing of the cranes as they are being moved into the CMR and to monitor contact maintenance operations in the CMR. This window is horizontally placed with a clear view of 40 in. wide by 22 in. high. The normal viewing angle is 46° horizontal by 11° up/47° down and extreme viewing angle is

80° horizontal by 69° vertical. The hot side oil gasket is located on the cold side of first piece of glass to shield it for a lower total integrated radiation dose. A separate hot side protective barrier is used to allow removal of the shield window without breaching the cell containment.

Refer to Hot-Cells Services drawings series 9152 for Type I, II, and III window details.

D. CPC North Window, 3M-1-D

The CPC north window is vertically placed with a clear view of 21 in. wide by 31 in. high. The normal viewing angle is 13° horizontal by 17° vertical and extreme viewing angle is 43° horizontal by 60° vertical.

No separate hot side protective barrier is used.

E. CPC West Window, 3M-1-A, 3M-1-B, 3M-1-C

The CPC west windows have a clear view of 30 in. wide by 37 in. high. The normal viewing angle is 17° horizontal by 20° vertical and extreme viewing angle is 70° horizontal by 70° vertical. No separate hot side protective barrier is used.

Refer to Corning drawings VP-4413-15-M-8- for CPC window details.

F. CCR Window

The CCR has a Zinc-Bromide window that has been converted to an oil filled window to provide observation of contact maintenance operations. This window is mounted horizontally with a clear view of 36 in. wide by 24 in. high. There is no internal glass shielding in this window. No separate hot side protective barrier is used. This window was added to the CCR after hot operations of the reprocessing plant commenced.

Refer to drawing 3B-T-1006 for the CCR window.

G. EDR Window, 15-M-3

The EDR has a Zinc-Bromide window that has been converted to an oil filled window to provide observation of contact maintenance operations and canister load-in. This window is approximately square with a clear view of 24 in. wide by 24 in. high. There is no internal glass shielding in this window. No separate hot side protective barrier is used.

Refer to drawing series VP-4413-M-17- for EDR window details.

H. Tunnel Viewing

There is no direct shield window viewing into the tunnel. CCTV will be used for routine viewing in the tunnel.

I. Shield Window Oil

Low viscosity, napthenic mineral oil is used as an optical coupler between the glass. Oxygen and moisture control for the oil is critical for continued oil clarity and to avoid damage to the glass from acid build-up.

J. Window Viewing Considerations

Due to the significant transmission loss of light through lead glass shielding in the shield windows, actual in-cell lighting levels must be over designed to assure an effective 50 footcandles through the windows. The lead glass in shielded viewing windows is a relatively poor transmission media for purple, blue, and green portions of the spectrum. Even at 589 nanometers (sodium peak from HPS lights) transmission is significantly reduced depending on the quantity of glass in the window. Color rendition through lead glass windows is, thus, not particularly good, and a strong yellow cast is imparted to the view. In addition, the selection of HPS lighting does not allow good color rendition. Thus, little dependence has been placed on color coding within the Vitrification Cell. Where identification is needed, or status, location, or position determinations need to be made, high contrast markings are used rather than color.

Since the refractive indices of all window glasses is relatively high compared to air, there is a significant bending of light rays as it passes through the glass/air interface. This is used to advantage in shield windows to provide a better viewing angle than would be expected by viewing through air alone through an opening in a thick wall. At the extreme viewing angle, significant distortion (like a fish-eye lens) will be encountered.

2.3.5 Closed Circuit Television

All cameras are radiation resistant, black and white, high resolution cameras. Each camera is equipped with a pan/tilt and a zoom lens, except for the CPC 16-ton trolley which is a fixed position/fixed focal length camera to assure a consistent view of canisters as they fit into the racks. An electronic "cross-hair" generator may be used on this camera as an additional targeting aid.

Each crane control station will have controls for all video cameras mounted on the crane. Cameras not mounted on the crane can be operated from any location within the given system, whereas the crane mounted ones can only be operated from one of the crane camera control stations. The view from the crane mounted cameras can be observed from any monitor within the given system. The control room can monitor any camera in either System I or System II.

Refer to Diamond drawing series 643500-, 644952-, and 7003 - for CCTV details.

A. Mounting of CCTV Cameras

CCTV Cameras are mounted in the Vitrification Facility as follows:

SYSTEM I, VF Facility
VF Cell.....6 (includes one portable camera)
Process Bridge.....4
Process Trolley.....1
Backup Bridge.....4
Backup Trolley.....1
Tunnel.....1
CMR.....2

SYSTEM II, HLWIS
EDR Crane.....2
CPC.....1
CCR.....1
CPC 16-Ton Trolley..1

2.3.6 VF Cell Lighting

A. VF Cell Lighting, 63A-P-LT01

> The Vitrification Cell is illuminated with 32 high pressure sodium (HPS) lamps, 400 watts each with ballasts located in the operating aisle. These light fixtures are remotely replaceable using the process crane. The process crane also has six HPS lights with ballasts built into the fixtures. The Vitrification Cell lighting was

designed to assure 50 footcandles effective lighting at all work stations. Due to the significant transmission loss of light through lead glass shielding in the shield windows, actual in-cell lighting levels are over 200 footcandles to assure an effective 50 footcandles through the windows. The CCTV system will operate effectively at significantly lower light levels, but will not be adversely affected by the higher light levels being provided. Lamps are instant restrike, which includes two arc tubes for increased life.

B. Tunnel Lighting

> The tunnel is illuminated with six HPS 100 watt fixtures for a lighting level of less than ten footcandles which is sufficient for CCTV viewing. There is no direct shield window viewing into the tunnel. Lamps are instant restrike, which includes two arc tubes for increased life.

C. CPC Lighting

The CPC crane lighting was originally eight self-ballasted, 450 watt mercury vapor high-bay type lights. These lights have been replaced with HPS fixtures identical to the process crane fixtures. Power for these lights comes from Lighting Panel D2. The CPC in-cell lighting was originally 14 remotely changeable 1000 watt mercury lamps with ballasts outside of the CPC. Seven of these lights have been replaced with new fixtures with 1000 watt HPS lamps and new HPS ballasts located outside of the CPC. Since no remote operations are possible in the CPC without the cranes in the cell, most of the lighting is from a single row of eight HPS fixtures on the 16-ton bridge crane and from a single row of six HPS fixtures on the two-ton/power manipulator bridge. The in-cell 1000 HPS lights will be sufficient for CCTV monitoring and general viewing without the cranes in the CPC. Power for these lights comes from Lighting Panel D2.

Refer to drawings 3-P-1 through 3-P-37 for CPC lighting details.

D. EDR Lighting

> The EDR lighting was originally eight self-ballasted, 450 watt mercury vapor high-bay type lights, mounted along the north and south walls. These lights have been replaced with HPS fixtures identical to the process crane fixtures. The lights are controlled from Lighting Panel D2. Provisions for battery back-up emergency

lighting have been made. The battery is located in the EDRVA, and hence supplies emergency lighting to that area. Lamps are instant restrike, which includes two arc tubes for increased life.

E. CMR Lighting

> The CMR lighting is 14 each, 100 watt HPS fixtures located on the east, west and south walls. Emergency lighting is provided. Lamps are instant restrike, which includes two arc tubes for increased life.

F. CCR Lighting

> The CCR lighting was originally six each, 300 watt incandescent fixtures mounted on the ceiling. These lights have been replaced with HPS fixtures identical to the CMR. Lighting power is from Lighting Panel F. Provisions for battery back-up emergency lighting have been made. The battery is located in the NAOA. Lamps are instant restrike, which includes two arc tubes for increased life.

2.3.7 Tooling

A. Twenty-Four Ton Capacity Lift Yoke, Short Span (63K-W-002)

This lift yoke is adjustable from 20 in. up to 48 in. inside span, in one inch increments. The yoke beam is positioned either on a stand in the EDR or on the transfer cart canister rack and a crane is used to adjust each lifting hook, one at a time. The beam is marked with letters on one side and numbers on the other side. The assembly drawing includes a table of span verses hook positions. The beam will be stored in the EDR.

Refer to drawing 900D-4876.

B. Twenty-Four Ton Capacity Lift Yoke, Long Span (63K-W-001)

This lift yoke is adjustable from 20 in. up to 120 in. inside span, in one inch increments. The yoke beam is positioned either on a stand in the EDR or on the transfer cart canister rack and a crane is used to adjust each lifting hook, one at a time. The beam is marked with letters on one side and numbers on the other side. The assembly drawing includes a table of span verses hook positions. The beam will be stored outside of the VF since it will only be needed for major equipment handling. Should the beam need to be used, a storage rack position is provided in the EDR.

Refer to drawing 900D-4876.

C. Twenty-Five Ton Load Test Assembly (63K-V-062)

The load test assembly is a stack of one-ton steel plates, with provision for using the impact wrench to drive an actuator pin through a central opening. The pin in the plate at the bottom of a stack of plates to be used is driven through a square tube with slots cut lengthwise. The square tube, called the lifting column is then picked up with a shackle on the square tube. The concept is similar to a "Universal" weight lifting machine. Two lifting columns are provided to allow two ten ton stacks to be used on the EDR crane. One lifting column has been shortened to 10-ton capacity to allow weights to be moved from the Vitrification Cell to the CMR. The top plate has a lift bail of its own such that it can be removed from the stack to provide 24-ton stack to test the lift yokes. Five of the plates are bolted together and are provided with a set of side lift bars for yoke load testing. The load test stack is stored on a stand which mounts on the cover of the EDR soaking pit. The weights can also be used as the counter weight for the Vitrification Cell crane recovery module and as ballast for the recovery cart.

Refer to drawing 900D-4875.

D. Impact Wrench (63A-V-001, 68-V-001, 55-V-001A, 55-V-001B)

The impact wrench is an adaptation of an Ingersol Rand air operated impact wrench. A 480 volt three-phase motor with an offset gearbox is used to power the unit. This allows rapid response and ease of reversing compared to an air operated wrench. There are three socket lengths available for the wrench, all of them 2" hex. The normal configuration will be the 11 inch socket to allow extended reach. The wrench has a two position bail to allow either horizontal or vertical use. The wrench also has an anti-rotation bar which slips down when the wrench is vertical. All components designed for vertical use of the wrench require at least one tab to engage with the stop to prevent crane cable wind-up. Some equipment uses the edge of the flange rather than a tab as a rotation stop. Power for the wrench is provided by cable reels on the 4.5-ton process hoists, the 25-ton main hoist, the CPC 2-ton hoists, and by a tether in the EDR. The VF Cell will maintain an impact wrench ready for use essentially at all times, EDR's will be stored, but ready, and the CPC wrench will be stored in the CCR requiring a manned entry to mount it on a 2-ton hoist. The impact wrench is also used for some light lifting, handling of PUREX dust covers, and operation of several remote operated valves.

A thermal overload is provided inside the motor of the impact wrench. The overload will reset in about two minutes on its own. Temporary failure of the impact wrench such as this should be reported to the Shift Supervisor.

Refer to drawing 900D-2555.

E. Impact Wrench Lift Adapter

A small lifter can be added to the socket of the impact wrench to allow the wrench to make minor lifts, such as canister temporary covers, electrical dust covers, thermocouples, and other light components. The adapter slides into the socket and latches to a groove one inch from the end of the socket. MSMs can be used to quickly add or remove the adapter.

Refer to drawing 900D-6025.

F. Vessel Tilting Assembly (63K-V-058)

This fixture bolts down to the transfer cart or trailer to allow tipping of components too tall to pass through the VF doors. The tilter has fixed trunnion guides for the CFMT and adjustable trunnion guides for the Decon station, HEME Vessels, Condenser, Agitator handling fixtures, and some jumpers which will have tipping trunnions. HEME elements and condenser tube bundles could also be handled in this manner, however, additional fixtures would be required. The fixture also has a hitch provision for towing the turntable using the turntable's cart track rails. The fixture will be stored outside of the VF since it will only be needed for major equipment handling. Should the fixture need to be used it will be stored in the EDR.

Refer to drawing 900D-4872.

G. Vessel Frame Cradle Assembly (63K-V-059)

This fixture bolts down to the transfer cart or trailer to allow tipping of components too tall to pass through the VF doors. The fixture has a nylon sling to support any load, regardless of shape. This fixture is used in conjunction with the tilt fixture. The fixture will be stored outside of the VF since it will only be needed for major equipment handling. Should the fixture need to be used it will be stored in EDR. Since the sling is not used for hoisting and rigging, no load test is required.

Refer to drawing 900D-4873.

H. Yoke Handling Pin

This fixture slides down into a hole in the Vessel Tilting Assembly and is used to carry the lifting yokes when the tilter is being used for major equipment handling. The tilter will be stored outside of the VF since it will only be needed for major equipment handling. Should the tilter need to be used it will be stored in the EDR.

Refer to drawing 900D-4874.

I. Discharge Lid Heater Rack/Guide

> This fixture is used to aid in installation of the Melter Discharge Lid Heater to avoid damage during installation. The fixture supports the Lid Heater and assures vertical insertion into the melter without tipping. The fixture is used in conjunction with the transfer cart trailer and the discharge lid lifting adapters. The handling fixtures may be used to store used discharge lids in the CPC, or they may be size reduced and packaged for removal. They are not reused.

Refer to drawing 900D-4696 and 900D-5367.

J. Evacuated Canister Handling Fixture(s)

This fixture is used to handle evacuated canisters, two at a time from Load-In to the VF Cell. The fixture bolts to a transfer cart trailer and allows lifting of the empty evacuated canisters onto the cart. The fixtures may be size reduced and packaged after use, since they are not reusable.

Refer to drawing 900D-5748.

K. Grapple Lifting Adapter

The grapple lifting adapter allows rapid conversion of the canister grapple to a normal hook. The adapter is a circular plate the size of a canister with a hook on the end of a 2 ft. long pipe extension. The grapple engages the plate and the hook is used as required for loads up to 4.5 tons. A storage fixture is provided which can be inserted into the hanger hole in a cell wall utility plug. The adapter can be used to load test the grapple.

Refer to drawing 900D-5381.

L. Canister Grapple

The canister grapple is a three hook mechanized lifter. The assembly is actuated by raising and lowering a weighted portion of the assembly to drive a rotating ratchet assembly. It provides one disengage position and two engage positions to avoid inadvertent actuation should a canister land on an obstacle. The grapple is designed to assure full engagement and full disengagement so that a canister cannot be lifted while partially engaged. A status indicator is provided to show the operator which position the grapple is in. An MSM operated override is provided to disengage the grapple should the actuation mechanism fail. Although there is no provision for actuating the grapple horizontally, the grapple is capable of horizontal lifting should canister lay down or up-righting be desired.

Refer to Bartholomew drawing series 9050-.

M. Extended Clevis

The 4.5-ton process hoists in the VF cell will be equipped with identical extended length clevises. The clevis is designed for Master Slave Manipulator operation such that loads can be secured to the clevis without manned entry. The manipulator is used to pull a spring pin and rotate a keeper plate out of a groove in the load bearing pin. The load bearing pin can then be removed to change the load. The clevises can be replaced (manned entry into CMR required) at any time with the original hooks should additional lift height be needed.

Refer to Bartholomew drawing series 9050-.

N. Canister Temporary Lid Handling Fixture

This fixture is used to store and carry temporary lids for later reuse. Two fixtures will be used, one stored on the transfer cart canister rack and the other sitting on the VF Cell apron floor near the In-Cell Canister Storage Rack. The two fixtures will be swapped at each four canister handling cycle. The fixtures provide surge capacity (total of eight lids per fixture).

Refer to drawing 900D-6143.

O. Manipulator Tong Change Fixture

This fixture is used at each window to allow manipulators to change tongs, since the tongs must stay in-cell when a manipulator is changed. The fixture has a heavy base to provide stability for one handed removals and has a wire rope bail so it can be crane handled if the fixture must be moved away from the window.

Refer to drawing 900D-5800.

P. Impact Wrench Right Angle Drive Adapter

> This fixture is used to allow the impact wrench to access free-nuts, capture bolts, and PUREX connectors which are too cramped to provide normal wrench access. Previously identified locations are the west-most Condenser hold down free-nut, the primary filter roughing filter actuator, and some free-nuts on the melter which are on the lower end of a spool. Additional locations may be found during testing.

> Refer to Drawing 900D-6720.

Q. Impact Wrench Socket Extension Adapter

> This fixture is used to allow the impact wrench to access free-nuts, capture bolts, and PUREX connectors which are too cramped to provide normal wrench access. Previously identified locations are the primary filter roughing filter actuator and some free-nuts on the melter which are on the lower end of a spool. Additional locations may be found during testing.

> Refer to Drawing 900D-6732.

R. Clevis Hook Adapter

This hook is used to allow an alternative quick conversion of the 4.5-ton process hoist to a hook. It is used in conduction with the clevis and mounts on the load bearing pin. The hook is a standard Crosby Hook # S-320-KC.

S. PUREX Nozzle Cleaner Impact Wrench Adapter

This fixture is used to allow the impact wrench to clean slurry or salt accumulation away from a PUREX nozzle to assure leak-tight fit-up when reinstalling slurry handling jumpers such as the WTF/CFMT jumpers, the ADS pumps, the Sampling pumps, and the Melter Feed Jumper. No details are available since the design is not complete.

T. Shield Window Cleaner

No details are available since the design is not complete.

U. Free Nut Handler Impact Wrench Adapter

No details are available since the design is not complete.

V. EDR Radiation Probe

The probe will be located in the EDR along the east side of the soaking pit. The probe will be used to determine whether a container of packaged waste can be removed to Lag Storage as low level waste without requiring manned entry for a survey. If the probe is above 100 mr/hr in its storage position when the can passes by, then the container must be stored in the CPC. If the probe is below 100 mr/hr, then the probe may be picked up with the EDR crane for a closer examination to determine container disposition.

Refer to drawing 900D-6497.

W. Hot/Warm/Cold Waste Handling Cans

Remote handled containers capable of fitting into 17C/17H 55 gal drums will be used to handle accumulated waste within the VF. Cans will be pre-labeled and efforts must be made to place waste into the appropriate can. Waste which has glass, slurry, or off-gas dust should be placed in hot cans. Waste with unknown activity, which have been in the VF cell for a significant length of time would be placed in warm cans. Recently introduced waste, such as consumable packaging or handling dunnage would be placed in cold cans. Disassembly and size reduction will be encouraged as operator/crane/manipulator time is available to further optimize waste storage requirements. Cans will be tracked with a log book system and changes in status from cold to warm, etc. will be noted. Dose rates will be

recorded along with contents for later waste processing support. Refer to drawing 900D-6491.

X. Parts/Equipment Handling/Storage Buckets

These buckets are grapple handled and resemble the top of a canister. They will be used for in-cell glass shard sample transfers, free-nut handling/storage, welder parts handling, and repaired subassembly storage for later use.

Refer to drawing 900D-6204.

Y. Canister Welding Lid Handling

Welding lids will be moved into the VF cell via the Load-In building. A disposable cable assembly will be used to provide a crane handle for packages of 16 to 24 lids. The cables will be removed and disposed of by the MSM once the lids are in the lid magazine.

Z. Light Fixture Handling Adapter for 24 Ton Yoke Beam

This adapter will allow use of the beam portion of the short yoke to provide a heavy off-set lift beam. The beam can then reach the bail on the light which is not within normal crane hook access. No details are available since the design is not complete.

AA. Electrical Connector Dust Covers

The covers provide a gasketed, dust and splash-tight seal for unused PUREX electrical connectors. The bail on the dust cover is within direct crane access.

Refer to drawing 900D-5260.

AB. PUREX Connector Dust Covers

The covers provide a splash resistant cover for unused PUREX connectors and also provide protection from damage to the seal surface. The same cover can be used on 2 in., 2 in.-3 way, and 3 in. connectors. The cover is handled with the impact wrench socket since they are not within direct crane access.

Refer to drawing 900D-5263.

AC. PUREX Connector Blanks

Blanks provide a pressure rated seal for extra PUREX connectors on process or off-gas equipment. The same blank can be used on 2 in. or ? in.-3 way, vertical or horizontal connectors. The blank has a tilting bail and is handled with any available hook. The blank may also be used for handling of assemblies that have no bail. Blank connectors should be inspected prior to use for possible damage to the Viton (TM) seal face.

Refer to drawings 900D-5312 and 900D-5313.

AD. Twenty-Four Ton Capacity Lift Yoke, 90• Adapters

These adapters provide hooks rotated 90• to the existing hooks to allow handling of equipment with hooks oriented in line. Guides are provided to help align the adapters to the bails prior to engaging with the bails. The adapters are installed and removed by the MSMs. Most gaskets can be handled with these adapters.

Refer to drawings 900D-5395.

AE. Melter Glass Sampler

This tool provides a means for sampling the melter glass pool for chemical adjustments prior to restart after prolonged idling. No details are available since the design is not complete.

AF. Melter Penetration Quick Cover

This tool provides a means for quickly covering melter nozzles during maintenance to reduce melter plenum cooling by excess air flow. No details are available since the design is not complete.

AG. Off-Gas Jumper Quick Cover

This tool provides a means for quickly covering off-gas jumper openings to reduce dust spread during handling. No details are available since the design is not complete.

AH. Primary Filter Pre-Filter Container

This tool provides a means for containing roughing filters to reduce dust spread during handling. No details are available since the design is not complete.

AI. Primary Filter Container

This tool provides a means for containing main primary filters to reduce dust spread during handling. No details are available since the design is not complete.

AJ. Remote Decon Tool

This tool provides high pressure water in conjunction with the crane hook, MSM, or the In-Cell Telerobotic Manipulator to decon equipment prior to removal from the VF Cell. No details are available since the design is not complete.

AK. Transfer Cart Decon Tray

This fixture provides a place to perform decon work which directs decon solutions directly to the VF Cell sump catch line between the transfer cart rails. The tray is built like a shower stall floor with a drain in the center which passes through a hole in the center of the cart/trailer frame. The tray is glass bead blasted and coated with Clear-cote(TM) to aid in decon of the tray itself.

Refer to drawing 900D-4870.

AL. Drain Grate Lift Magnet

Should the in-cell drain grates need to be removed, a magnet will be used, as they are fabricated out of 410 stainless steel which is somewhat magnetic.

AM. Sister Hook/Overload Indicator

A Below-the-Hook accessory is used when handling components, which could be damaged, due to binding during removal. This component provides visual indication to the crane operator that an unexpected load has been encountered, without waiting for the hoist overload switch to take effect.

AN. EDR/CPC 2-Ton Hatch Cover

A 2-Ton steel plate is used as a shield cover between the EDR and CCR in the manipulator repair hatch. This cover is also used to load test the CPC 2-Ton hoists.

Refer to drawing 900D-2617.

AO. Melter Thermocouple Handling Fixture

This fixture is used to transport new thermocouples from the EDR to the melter. The fixture provides sufficient rigidity to the thermocouple to prevent handling damage and will allow the thermocouple to be laid down or picked back up without bending the thermocouple.

Refer to drawing 900D-6277.

AP. CFMT and MFHT Agitator Gearbox Lube Fixture

> This fixture is used to add gearbox lube to the agitator gearboxes in the event that the oil level goes down. Oil level will be monitored remotely using CCTV cameras to observe a level indication added to the gearbox.

> Refer to Drawing 900D-6584.

AQ. Clevis Lift Bail

This tool is used to pickup turntable canister pedistals and various equipment on the weld station.

Refer to Drawing 900D-4750, sheet 3.

> AR. Remote Gasket Removal Tool

This tool is used to handle remote gaskets. It is adjustable using MSM to handle 12-36 inch spans.

> Refer to Drawing 900D-6730.

2.3.8 In-Cell Telerobotic Manipulator

The In-Cell Telerobotic Manipulator is a two armed, hydraulically powered, servo-controlled manipulator system capable of operation as a master-slave unit under operator control and as a robot under total computer control. The master control console contains independent kinematically similar controls to simultaneously control all movements of the corresponding slave arm. The crane deployed In-Cell Slave Unit contains two slave arms, an on-board hydraulic unit, and control microprocessor. The control signals and electric power are supplied to the Slave Unit via a tether. Each slave arm has a lifting capacity of 150 lbs. at 76 in. reach with six degrees of motion fr dom. The slave arm can remotely exchange it's gripper ha. with a universal tool adapter that interfaces to standard commercial power tools (end effectors). Power for the end of the effector is routed through the slave arm. The ITMS can be deployed in any cell that has a means for connection of the tether either remotely using an MSM or by manned entry.

It is anticipated that the ITMS will be used only during "off-normal" recovery operations and for unusual repair operations where the ITMS features may simplify or expedite the repair. No dependence has been placed on the operational ability of the ITMS in the design philosophy of any components in the remote handling system and any other system.

2.3.9 Shield Door Controls

A. VF Cell/Tunnel Shield Door, 63-M-001

A 13-inch thick steel shield door between the Vitrification Cell and the tunnel opens to the east. The door is driven by a 2.75" dia. ball screw at 1.4 fpm.

Full travel time is 9.6 minutes. Travel limit switches are located at either end of the door. Seismic latches are provided for the closed position. These are small, self-contained, ball screw actuators which drive pins into a double-shear type connection. Limit switches next to the pin actuators assure the door may not be opened until the pin is free.

An air inflated seal is used around the top and sides. The control system will not allow the door to be opened until the seal air pressure is reduced below a pressure switch set point to assure there is no side load on the door while operating it. The decision whether to activate the seals after closing the door is controlled by System 67, HVAC.

> The door is operated from a control station at the north viewing window of Vitrification. Door control is relay logic, powered from the same source as the door drive power. Permissive contacts are included from the transfer cart system and door status is provided back to the cart. Permissive contacts are also provided by the time delay/warning system, PP-6 Circuit #8.

> A time delay/audible/visual warning system is included in the door controls to provide adequate warning that a door is about to open. Warnings are provided in the load-in building, the secondary filter room, the CMR and the CMOA.

Repair access to the door drive is outside on the east side of the Vitrification Facility. Repair access to seismic pins, air seals, limit switches, and ball nut is via the EDR/Tunnel.

Refer to drawing 63-M-001-15.

B. Tunnel/EDR Ventilation Door, 63-M-008

A two-inch thick steel, twin leaf ventilation control door is located between the EDR and the tunnel. This door swings open to the north in approximately 2.5 minutes using two linear actuators. Door travel limit switches are located on the tunnel walls. Seismic latches are provided for the closed position, identical to those on the 63-M-001 door. Limit switches next to the pin actuators assure the door may not be opened until the pin is free. The door is operated from a control station at the north viewing window of Vitrification. Door control is relay logic, powered from the same source as the door drive power. Permissive contacts are included from the transfer cart system and door status is provided back to the cart.

No time delay/audible/visual warning system is provided for this door.

Repair access to all door components is via the EDR.

Refer to drawing 63-M-001-15.

C. EDR/CPC Shield Door, 3-M-3

A four-foot thick concrete filled shield door opens to the west between the EDR and CPC. The door is driven by a 1.5" dia. ball screw at 2 fpm. Full travel time is 5.75 minutes. Seismic latches are not provided. There is no ventilation seal around this door.

> The door is operated from a control station at the EDR viewing window. Door control is relay logic, powered from the same source as the door drive power. Permissive contacts are included from the transfer cart system and door status is provided back to the cart. Permissive contacts are also provided by the time delay/warning system, PP-6, Circuit #8.

> A time delay/audible/visual warning system is included in the door controls to provide adequate warning that a door is about to open. Warnings are provided in the loadin building, the secondary filter room, the CMR and the CMOA.

Repair access to the drive is in the EDRVA. Repair to wheels and the ball nut are via a hatch on the EDR roof.

Refer to drawing 900B-4153.

D. VF Cell/CMR Shield Door, 63-M-002

> A vertical lift, nine-inch thick steel shield door is located between the CMR and the Vitrification Cell to allow contact maintenance of the Vitrification Cell cranes. This door is lifted by twin 52-ton hoists at a travel rate of 8/0.8 fpm for an opening time of 1.7/17 minutes. Travel limit switches are located in the hoist. Seismic latches are provided for the open position, using actuators to swing heavy bars into catches on the top of the door. Latch travel limit switches are located on the latch mounting plates. The door then rests on the concrete roof of the VF Cell and the CMR.

An air inflated seal is used around the top and sides, while the door rests on a passive seal when closed. The control system will not allow the door to be opened until the seal air pressure is reduced below a pressure switch set point to assure there is no side load on the door while operating it. The decision whether to activate the seals after closing the door is controlled by System 67, HVAC. Cut-outs are provided in the door for the crane runway and power track system.

> The door is operated from a control station at the CMR viewing window of Vitrification. A permissive switch is located at the north viewing window of Vitrification. A permissive contact is also provided by the time delay/warning system, PP-6, Circuit #8. Door control is a PLC, powered from the same source as the door drive power. The door hoists are synchronized by optical encoder feedback to the PLC. A microspeed drive is used to start, stop, and fine position the door for synchronization. Status of the door air seal, and the seismic latches are also fed back to the PLC and are included in the door control software to assure safe operation of the door.

> A time delay/audible/visual warning system is included in the door controls to provide adequate warning that a door is about to open. Warnings are provided in the load-in building, the secondary filter room, the CMR and the CMOA.

Repair access to all door active components is via the door hoist area (term).

Refer to BISCO (DeMag) drawing series 280-932-49-.

E. CCR/CPC Shield Door, 3-M-2

The CCR shield door is a vertical lift, three-foot thick, concrete filled door. The door is raised by twin 75-ton hoist drums driven from a common motor/gearbox at 2.5 fpm. Travel time is 6.4 minutes. The door is controlled from the CCR viewing window. Door control is relay logic, powered from the same source as the door drive power. There is no ventilation seal around this door.

> A time delay/audible/visual warning system is included in the door controls to provide adequate warning that a door is about to open. The time delay/warning is powered by the door circuit and gives local warning in the north analytical operating aisle only.

Repair access for all active components is via the CPC (door) penthouse.

Refer to drawing 900E-4576.

F. Door/Cart Interface

The shield doors along the transfer cart rails, 63-M-001, 63-M-008, 3-M-3, are interlocked with the transfer cart control system software to assure that doors are not operated when the transfer cart is moving and that the transfer cart cannot be moved when doors are moving. In addition, the cart controller will only allow one door to be open (ie. fully closed limit switch not tripped) at a time. This interlock can be overridden at the cart engineering station at the EDR viewing window in the event that more than one door needs to be opened to support a special remote operation such as cart retrieval.

2.3.10 In-Cell Canister Storage Rack (63-W-060)

An eight canister storage rack, fabricated of 304L stainless steel is located just south of the canister turntable in the VF Cell pit area. The rack is a four by two array oriented with it's long axis east/west. A guard is provided south of the rack to protect waste header piping and decon solution piping from damage by inadvertent setting a canister on the pipes.

Refer to drawings 900D-5032 through 900D-5036.

2.3.11 Canister Load-in Receiver

A passive, gravity operated tipping fixture is located in the EDR adjacent to the shielded load-in port. Canisters are pushed in, horizontally, through the load-in port on a series of ball casters. Once the canister passes a critical point in the tipping fixture, the canister mass causes the fixture to tip, presenting the top of the canister to the EDR crane. Once the EDR crane removes the canister, the fixture tips back to its horizontal position. The fixture pivots on pillow block bearings and uses a pneumatic cylinder to cushion both ends of the cycle. All contact points for the canister are stainless steel.

Refer to drawings 900D-5903 through 900D-5909.

2.4 Interface Descriptions/Requirements

63ED - Electrical Distribution

This system provides electrical power and control wiring for the 63K cranes, manipulators, transfer cart, and shield door controls. It provides communication services to 63K for multi-station operations and coordination with control room operations.

The following table lists Vitrification Facility Electrical Distribution System Interfaces:

Vitrification Facility:

DESCRIPTION	POWER SOURCE	SWITCH	LOCATION	VOLTS
Kranco Cranes	A1	1DR	DGR	480 V
CMR Hoists	A1	1EL	DGR	480 V
Door 63-M-002	A2	1DL	HVCR	480 V
Door 63-M-001	A2	1DR	HVCR	480 V
Door 63-M-008	LP-2	34	MEOA	120 V
CMR Crane	A2	1CR	HVCR	480 V
CMR Lights	PP-6		HVCR	120 V
Tunnel Lights	PP-6	10,12	HVCR	120 V
Cell Lights	LP-3		MEOA	120 V
CCTV Box 5	PP-6	14	HVCR	120 V
CCTV Box 12	PP-7	4	HVCR	120 V
MSMs				120 V
> Door Alarm/Flashers	PP-6	8	HVCR	120 V

The following table lists Process Plant Electrical Distribution System Interfaces:

Process Plant:

DESCRIPTION	POWER SOURCE	SWITCH	LOCATION	VOLTS
EDR Crane	MCC8	4E	EMOA	480 V
3V-1 Crane	MCC8	2B	EMOA	480 V
3V-2 Crane	MCC8	2C	EMOA	480 V
EDR/CPC Door	MCC8	8C	EMOA	480 V
CCR/CPC Door	MCC8	8G	EMOA	480 V
EDR Lights	LP-D2	2,4,6,8	COA	208 V
3V-1 Lights	LP-D2	10,12	COA	208 V
3V-2 Lights	LP-D2	14,16	COA	208 V
CCR Lights	LP-F	2	ANA	120 V
CPC Lights	LP-D2	1,3,5,7,9, 11, 15, 17, 19, 21, 23, 25, 27	COA	120 V
Old Cart	MCC8	7C	EMOA	480 V
Cart Controller	LP-D	3	COA	120 V
Cart Charger 1	LP-D	4	COA	120 V
Cart Charger 2	LP-D	6	COA	120 V
CCTV	LP-D	2	COA	120 V

63F - Cell Walls

This system provides structural support for 63K equipment and provides shielding for operation and maintenance of 63K equipment.

63G - Waste Header

> Maintenance support and viewing services are provided to this system. Provides waste handling support to 63K to allow decon of 63K equipment and components of other systems as it is performed by 63K. Note that the waste flow to 63G is via floor drains in system 63 WW.

63H - Off-Gas

Maintenance support, viewing, and remote valve operation services are provided to this system.

63I - Main Process

Maintenance support, viewing, and canister handling services are provided to this system.

63IA - Instrument Air

Provides air to inflate seals on 63-M-001 and 63-M-002 shield doors.

To inflate the seals, air is 10 psi and approximately 5 cfm for one minute.

63J - Canister Decon

Maintenance support, smear surveys, and viewing services are provided to this system.

63K - Remote Handling, Maintenance, and Viewing

Remote Handling, Maintenance, and Viewing provides maintenance support and viewing services to most components within the system itself.

63L - Welding

Maintenance support and viewing services are provided to this system.

63M - Load-In/Load Out

Provides canister handling outside of the EDR.

67 - Heating, Ventilating, and Air Conditioning

Maintenance support and viewing services are provided to this system. Also, door controls are provided to assure shield/ventilation doors are operated correctly. The HVAC system provides contamination control support to 63K for operation and maintenance of 63K equipment.

68 - High-Level Waste Interim Storage

Provides remote handling and viewing to this system.

69A - Vitrification Sampling

Maintenance support, viewing, sampler operation, and sample handling services are provided to this system.

2.5 Periodic Test Requirements

2.5.1 Crane Load Testing

In accordance with the SOP-15-56, all VF cranes and rigging will be load tested every three years. All rigging shall be load tested yearly as required. Some components may be allowed to have their rating lapse for a period. The 25-ton load test assembly can be used by selecting the number of one-ton weights to be used to perform all load tests required in the VF. Manned entry into the EDR, CMR, or CCR will only be required for post load test inspections.

A. DOE Hoisting and Rigging Manual Exceptions

The following exceptions will be documented to avoid the requirements listed below:

- Full runway load tests and to limit trolley-way load tests will not be required to avoid carrying loads over critical components.

- Lift fixtures designed for loads less than 100 Lbs. will also be exempted from periodic load tests.

- MSMs and power manipulators will also be exempted.

- CCR and CMR door hoists will be exempted since their load is fixed. Yearly inspections will be required.

B. Load Test Practices

- The CMR transfer hoists can be loaded tested using a 10-ton load stack on the load test fixture. A short lifting column is provided which allows moving 4-ton stacks of weights off of the transfer cart to the CMR. The stacks can then be configured into a 10-ton stack. The hand rails must be removed along the crane rails, and a stabilizing platform must be installed to hold the weights safely under the hoists.

- The normal WVNS practice of using load test tags will not be used for lifting components within the contaminated area. Safe Working Load (SWL) marking locations have been provided to allow the use of large vinyl letters to change the SWL based on the most recent load test. Load test due dates will be tracked in the WVNS open items tracking

system. For cranes, load test tags will be placed on the operating consoles.

- The transfer cart does not require load testing since it is not lifting equipment.

- The melter installation/removal track bridge does not require load testing since it is not lifting equipment.

- The load test fixture is considered load tested after it is used to load test the Vitrification 25-Ton Crane or the EDR Crane for the short load test lifting column.

- The canister grapple is load tested yearly using the grapple lifting adaptor. See section 2.3.7.K.

2.5.2 Crane Motions

Prior to filled canister handling operations, test all crane(s) motions required for canister handling (hoist, trolley, bridge, both directions) at both speeds to verify correct control system operation. If the crane(s) will not respond to any one motion/speed setting, then the canister lift should not be made since back-up capability is compromised.

Status lights with light burn-out test functions built-in should be tested prior to each use.

2.5.3 CPC 16-Ton Load Lowering Device

Once every three months, operation of the CPC 16-Ton Load Lowering Device should be checked with the PaR to verify correct operation.

2.5.4 CPC 16-Ton Bridge Recovery System

Once every three months, operation of the CPC 16-Ton Bridge Recovery System should be checked to verify correct operation of the winch.

2.5.5 CPC 16-Ton Hoist Control Operation

Once every month, operation of the back-up CPC 16-Ton hoist control should be checked to verify correct operation.

2.5.6 Transfer Cart Antenna

The transfer cart control enclosure utilizes two antennas and a diversity selection system. The control system engineering station records antenna usage. Monthly checks should be made to determine if the diversity detection system is correctly switching from one antenna to the other. Once the cart is installed, a base-line ratio of east to west antenna usage will be established. If the antennas were perfectly designed and fabricated, a 50/50 split would be predicted. Due to very slight variations in the antennas, cables, and circuitry, the actual split could be as skewed as 5/95. A consistent change over time of more than 20 percentage points must be evaluated by engineering. A consistent split of 0/100 is unacceptable, and testing/repairs must be undertaken to assure antenna diversity detection is functioning.

2.5.7 Transfer Cart Battery Status

The transfer cart control enclosure contains the batteries which supply the power to the cart control and motor power. The control system engineering station records charging, voltage, and temperature information relating to the general health of the battery/charging system. Monthly checks should be made to determine if the battery/charging system is functioning satisfactorily.

2.5.8 Shield Window Oil Sampling

All VF shield window oil must be sampled on a yearly basis. The oil shall be analyzed for Neutralization number in accordance with ASTM-D974. Oil should be less than .008 KOH/g. Oil should be changed if it exceeds this value. Oil should also be changed if there is any cloudiness, or after every three years.

2.5.9 Door 63-M-001 and Door 3M-3

Once per year, the ball screw, ball nut, bearings, wheels, track, and in-cell limit switches should be checked and lubricated.

3.0 OPERATIONAL REQUIREMENTS

The majority of activities in the In-Cell Remote Handling, Maintenance, and Viewing System are low level operational tasks. These have been described in Section 2 of this document as part of the functional and component descriptions.

Described below are high level organizational activities which will require adherence to operational procedures.

3.1 Transfer Cart Operation

Operation of the transfer cart is described in Appendix B.

3.2 Canister Movement

An eight canister storage rack is located in the pit south of the turntable. The rack can store empty canisters, filled canisters, welded canisters, and decontaminated canisters or any combination thereof. A four canister handling cycle will be used, where four empty canisters are moved into the Vitrification Cell on the transfer cart and traded one at a time for canisters which have been filled, welded, and decontaminated and are thus ready for interim storage.

To remove a canister from the turntable, the turntable Load-in Load-out port cover seal must be removed and set on a storage spot provided on the turntable. The top hat has a canister flange on its top so that the canister grapple may be used directly, avoiding a remote tool change. The filled canister may be moved to the storage rack or directly to the welding station. If the canister is stored in the rack, then a temporary cover will be placed on it using the impact wrench.

After lid welding, the canister may be moved either to the storage rack or directly to the decontamination station. After decon the canister would normally be moved back to the storage rack, however, other temporary storage locations could be used such as the weld station or the transfer cart.

In order to provide recovery capability from grapple failure, it is imperative that at least one canister storage position near a shield window be left open. One of the two weld station locations or the decon station must be available to place the canister within MSM access so the override can be used to remove a failed grapple.

Canisters will not be placed in the Vitrification Facility in locations other than the turntable, the in-cell storage rack, the weld station, the decontamination station, the transfer cart, the interim storage racks in the CPC, or on the process crane or the CPC 16-ton crane using the canister grapple. Additionally, empty canisters may be stored in the EDR as required. The EDR crane will not be used to handle filled canisters due to its lack of recovery capability.

3.3 CPC 16-Ton Crane

If any speed in any motion will not respond to console control, notify the Vitrification Shift Supervisor. Switch to "B" rack to see if the problem is in the "A" rack. Operations should be secured as soon as possible since back-up capability is compromised.

4.0 LIMITATIONS, PRECAUTIONS, RANGES/SETPOINTS

4.1 Limitations

Limitations for the transfer cart, shield doors, canister transfers and movement, and the CMR floor loads are listed below.

4.1.1 Transfer Cart

Transfer Cart limitations are described in Appendix B.

4.1.2 Shield Doors

The tunnel doors 3M-3, 63-M-001, and 63-M-008 shall not be opened when EDR door 63-M-003 is opened to prevent loss of adequate negative pressure in the HVAC system or in the Head End Vent System of the Main Plant.

Remotely operated shield doors 3M-2, 3M-3, 63-M-001, 63-M-002, and 63-M-008 must be observed during operation either through shield windows or by CCTV. Doors shall not be operated "blindly."

Verification must be made that no personnel will be exposed to very high or high radiation prior to opening shield doors 3M-2, 3M-3, 63-M-001, and 63-M-002.

4.1.3 Canister Transfers

The transfer cart must be observed either through shield windows or by closed circuit television. The cart shall not be operated "blindly."

To avoid exposure to increased radiation, full canister transfers from the Vitrification Cell to the CPC should not be made while personnel are in the CMR, CMOA, or the CCR.

Full canister lift heights should be kept to the minimum in the Vitrification Cell to avoid increased radiation in the CMR and the Vitrification Ex-cell upper floor regions.

Full canisters shall not be lifted with the EDR crane since there is no back-up or recovery capability should the crane fail.

The area east of the EDR at the 100 Ft. elevation and the EDRVA shall be secured during full canister transfers from the VC to the CPC to avoid personnel exposure to increased radiation. When stopping the cart in the EDR to close and open doors, the cart should be moved south of the charge shoes to reduce the time spent at the thin section of the EDR east wall.

When operating the cranes, failure of any motion at any speed should be reported to the Vitrification Shift Supervisor. Canister handling should be secured as soon as possible since back-up capability is compromised.

All required motions should be tested prior to canister handling.

4.1.4 Canister Storage

Canisters shall be stored only in approved racks to reduce possibility of damage from toppled canisters. Approved racks include the In-Cell Storage Rack, the turntable, the weld station, the decon station, the transfer cart, and the CPC storage racks.

4.1.5 Loads Lifted Over Primary Filters

Loads should not be lifted across the primary filters in the Vitrification Cell to reduce possibility of damage.

4.1.6 CMR Floor Load

Floor load limitations of 250 lbs. per square ft. for the CMR floor must be followed.

4.1.7 Shield Windows

Floor load limits must be observed when removing or replacing shield windows.

4.2 Precautions

4.2.1 Pre-Filter Housings

On the primary filter housings, the northeast CAM must be unlatched before the pre-filter latch is opened or closed to avoid damage to the operating mechanism.

4.3 Ranges/Setpoints

4.3.1 Shield Doors

The alarm duration for shield doors is 15 seconds. The delay/flashing beacon duration for shield doors is two minutes.

4.3.2 Facility Components

Temperature operating ranges for facility components are in Design Criteria, WVNS-DC-022 and Design Criteria, WVNS-DC-048.

4.3.3 CPC Cranes

The CPC cranes should not be used in the CPC if temperatures in the CPC exceed 100°F due to control system thermal limits. Thermal loads are further described in WVNS-DC-048.

5.0 CASUALTY EVENTS

5.1 Failure of Hoist Electrical Systems, Process Crane

Casualty Event: Hoist fails to respond to power input, canister is stranded on crane.

Mitigation: Multiple speed motor requires failure of both speeds. Grapple is designed for manipulator actuation. Hoist is designed for lowering of loads using load lowering module.

Recovery: Set-up hoist failure recovery module on back-up crane and use to lower a load.

5.2 Failure of Canister Grapple to Release Canister

Casualty Event: Grapple will not actuate, canister is stranded on crane.

Mitigation: Grapple is designed for manipulator actuation. Clevis is designed for manipulator disconnect of grapple.

Recovery: Move canister to weld station or decon station and use manipulator to actuate grapple or remove grapple from clevis.

5.3 Failure of Bridge Drive Motor, Process Crane or CPC 16-ton Crane

Casualty Event: Bridge drive fails to respond to power input, bridge is stranded.

Mitigation: Multiple speed motor requires failure of both speeds. Redundant drives require failure of both drives to strand bridge.

Recovery: Set-up tow latches on back-up crane and use to tow failed bridge to CMR. Use PaR manipulator bridge to attach towing latch to CPC 16-ton bridge and use winch to tow back to CCR.

5.4 Failure of CPC Manipulator Bridge Drive

Casualty Event: Bridge drive fails to respond to power input, bridge is stranded.

Mitigation: Redundant drives require failure of both drives to strand bridge.

Recovery: Use 16-ton hook to engage north girder of manipulator bridge and tow bridge to CCR.

5.5 Failure of Transfer Cart Controller

Casualty Event: Transfer cart fails to respond to request to drive and is stranded.

Mitigation: Redundant drives require failure of four drives to strand cart. Multiple antennas used to reduce signal null likelihood. Controller is remotely replaceable. Recovery cart is available.

Recovery: If cart is within crane access area, use crane to replace control module. If cart is not within crane access use recovery cart to push cart towards unloading location, then tow it to repair location.

5.6 Canister Lost from Grapple

Casualty Event: Mechanical failure of grapple causes drop of canister.

Mitigation: Conservative mechanical design of grapple. Yearly load test and inspection of grapple.

Recovery: Recovery scenarios are too varied for an exact recovery plan. In most scenarios, a fixture is fabricated to secure the canister and remove it from whatever location it has fallen into.

5.7 Canister Lost from Hoist

Casualty Event: Mechanical failure of hoist causes drop of canister.

Mitigation: Conservative mechanical design of hoist. Regular load test and inspection of hoist.

Recovery: Recovery scenarios are too varied for an exact recovery plan. In most scenarios, a fixture is fabricated to secure the canister and remove it from whatever location it has fallen into.

5.8 CPC 16-ton Hoist Fails to Respond to Controller

Casualty Event: PLC failure or cable failure disables control.

Mitigation: Redundant PLC outputs on crane. Secondary power system available for hoist.

Recovery: Try fast speed down. Try switching to rack "B" PLC output. Use stand-by controller to apply power directly to hoist motor to lower load. Use PaR to operate load lowering device to lower canister.

5.9 Master Slave Manipulator Fails

Casualty Event: Mechanical failure of manipulator puts it out of service.

Mitigation: Operating loads on manipulators have been made as low as possible.

Recovery: Remove manipulator using ex-cell monorails and appropriate Radiological Controls. Repair manipulator in the MSM Repair shop and return to service.

5.10 Shield Door 63-M-001 Drive Ball-Nut Jams

Casualty Event: Mechanical failure of ball-nut causes door to jam partially open

Mitigation: Lightly loaded ball-nut not likely to fail.

Recovery: Remove all ex-cell drive components. Jack door closed using pushing penetration provided. Pocket provided in the SFR/Tunnel wall takes in the screw should it protrude West of the door. Once door is closed, manned entry via the EDR and door 63-M-008 can be performed to effect repairs.

5.11 Shield Door 3-M-3 Drive Ball-Nut Jams

Casualty Event: Mechanical failure of ball-nut causes door to jam partially open.

Mitigation: Lightly loaded ball-nut not likely to fail.

Recovery: Manned entry via the hatch for 3-M-3 can be performed to effect repairs. (The door area provides a completely shielded area).

5.12 Power Failure Shuts Entire System Down

Casualty Event: Power from site feed is not available.

Mitigation: All components shut down safely and must be restarted.

Recovery: Transfer cart has its own UPS, but should not be operated, since it cannot be observed during a power outage. All other components in the system shut down safely and are not required during a power outage. Other than lighting, all components must be turned back on prior to use.

6.0 REFERENCE DOCUMENTS

WVNS-DC-011	General CTS Component Design Criteria
WVNS-DC-022	Vitrification of High-Level Wastes
WVNS-DC-032	Vitrification Facility Cell Crane System
WVNS-DC-048	Canister Storage System/High-Level Waste Interim Storage System Design Criteria
WVNS-DC-061	In-Cell Telerobotic Manipulator System
WVNS-EQ-230	VF Cell Crane System
WVNS-EQ-307	Vitrification Facility Master-Slave Manipulators
WVNS-EQ-308	VF Equipment Specification for Oil-Filled Shielded Viewing Windows
WVNS-EQ-309	Canister Grapple
WVNS-EQ-315	Closed Circuit Television System for Vitrification Process
WVNS-EQ-329	Vitrification Facility Sample-Cell Master-Slave Manipulators
WVNS-EQ-333	In-Cell Light Fixtures
WVNS-EQ-340	Chemical Process Cell 16/2 Ton Crane Modifications
WVNS-EQ-356	Fabrication of the VF Transfer Cart System
WVNS-EQ-368	In-Cell Telerobotic Manipulator System
WVNS-EQ-383	Fabrication of Miscellaneous Vitrification Components
WVNS-EQ-386	Load Lowering Device 68-W-001
WVDP-204	WVDP Q-List
SOP-15-56	Inspecting and Load Testing Mechanized Hoisting Equipment
EP-2-001	Determination of Required HLW Designation
ORNL-TM-64350	West Valley Transfer Cart Control System Design Description
WVNS-CS-134	Vitrification Facility Civil Structural Installation
WVNS-CS-139	Vitrification Mechanical I&C Electrical Installation

APPENDIX A - Reference Drawings

14762-C	G1B-RB1G
14763-C	HOIST ELECT FAIL REC. MODULE G1B RB20 VIT FAC, VIT CELL CRANE SYS.
20345-B	HOIST ELECT. FAIL REC. MODULE WAY COVER VIT. FAC. VIT CELL CRANE
21530-D	HOIST ELECT. FAIL REC. MODULE RB SLIDES X-Y-Z ASSY VIT FAC. VIT CELL CRANE
21562-C	HOIST ELECT FAIL RECOVERY MODULE END PLATE RB24 VIT FAC, VIT CELL CRANE SYS.
21577-D	HOIST ELECT. FAIL RECOVERY MODULE BASE RB24 VIT FAC, VIT CELL CRANE SYS.
21578-D	HOIST ELECT. FAIL RECOVERY MODULE BASE RB20 VIT FAC, VIT CELL CRANE SYS.
21580-D	HOIST ELECT FAIL REC. MODULE BASE RB16 VIT. FAC, VIT CELL CRANE
21586-D	HOIST ELECT FAIL REC. MODULE CARRIER RB16 VIT FAC, VIT CELL CRANE
21588-D	HOIST ELECT FAIL RECOVERY MODULE CARRIER RB20 VIT FAC, VIT CELL CRANE SYS.
21590-E	HOIST ELECT FAIL RECOVERY MODULE CARRIER RB24 VIT FAC, VIT CELL CRANE SYS.
21597-D	HOIST ELECT FAIL REC. MODULE RB16-42-16-L-20T-MBKT-AWC ASSY VIT. FAC. VIT CELL CRANE
21599-D	HOIST ELECT FAIL REC. MODULE RB20-36-20-L-12T-MBKT-AWC ASSY VIT. FAC, VIT CELL CRANE
21600-D	HOIST ELECT FAIL REC. MODULE RB24-54-24-L-24T-MBKT-AWC ASSY VIT FAC, VIT CELL CRANE
025584 -	ELECT. RUNWAY CONDUCTOR SYS. CANTILEVER ROLLER SUP. 8.630 STN STL VIT FAC, VIT CELL CRANE
025679	ELECT RUNWAY CONDUCTOR SYS MTG. FLANGE SHAFT WLDMT. STN STL, VIT FAC, VIT CELL CRANE
025681	ELECT RUNWAY CONDUCTOR SYS DRUM WELD. 8.63 DIA 11.00 WD STN STL, VIT FAC, VIT CELL CRANE
025776	ELECT. CABLE REELS COLLECTOR COVER WELDMENT VIT. FAC. VIT. CELL CRANE SYS.
025778	ELECT. CABLE REELS VERTICAL FRAME SPRING END 21.00 STAIN. STEEL VIT. FAC. VIT CELL CRANE

025779	ELECT. CABLE REELS VERTICAL FRAME COLLECT END 21.00 STAIN. STEEL VIT. FAC. VIT CELL CRANE
025780	ELECT. CABLE REELS BASIC REEL ASSY SPEC. MMD21 STAIN. STEEL VIT. FAC. VIT CELL CRANE
025786	ELECT. CABLE REELS JUNCTION BOX WELD. STAINLESS STEEL VIT. FAC. VIT CELL CRANE SYS.
025805	ELECT. CABLE REELS ROLLER GUIDE BRACKET STAINLESS STEEL VIT. FAC. VIT CELL CRANE SYS.
025861	ELECT. CABLE REELS WRAPPER WELDMENT STAINLESS STEEL VIT. FAC. VIT. CELL CRANE SYS.
643500 -	Series drawings from Diamond, Vendor #4008
644952 -	Series drawings from Diamond, Vendor #4008
7003 -	Series drawings from Diamond, Vendor #4008
900B-4153	Vitrification Facility Wiring Diagram Schematic for 3M-3 Shield Door
900D-1759	Vitrification Facility Material Handling General Arrg't.
900D-1760	Vitrification Facility Material Handling General Arrg't.
900D-2555	Vitrification Canyon Impact Wrench Assembly
900D-2559	HLWIS 3V-1 CRANE MODIFICATIONS DRIVE INSTALLATION
900D-2560	HLWIS 3V-1 CRANE MODIFICATIONS REEL INSTALLATION
900D-2561	HLWIS 3V-1 CRANE MODIFICATIONS LIGHT INSTALLATION
900D-2562	HLWIS 3V-1 CRANE MODIFICATIONS MISC DETAILS
900D-2563	HLWIS 3V-1 CRANE MODIFICATIONS DETAILS
900D-2564	HLWIS 3V-1 CRANE MODIFICATIONS BRIDGE STOP INSTALLATION
900D-2617	EDR/CPC Hatch Cover Detail
900-D-2647	ELECTRICAL MOTORS E-111825-0033 HRI TORQUE DRIVE VIT. FAC. VIT. CELL CRANE SYS.
900-D-2648	60 SERIES BRAKE OPERATOR ASSY RELEASE
900-D-2649	VIT. FAC. VIT CELL CRANE SYS PT600 CHANNEL CARRIER WLDT S.S. 11.00 RAD 8.00" WD
900-D-2650	RECOVERY MODULE TORQUE DRIVE HOOK ROTATOR PROC. TROLLEY TURNTABLE BRG. DET. TURNTABLE DRIVE BRIDGE
900-D-2651	025564 ELECT. CABLE REELS ROLLER GUIDE ASSY. VIT. FAC. VIT CELL CRANE SYS.

900-D-2652	SPRING HOUSING ASSY. SPRING HOUSING SPECIAL STNLS STEEL
900-D-2653	025770 ELECT. CABLE REELS FRAME WELDMENT S21 STAINLESS STEEL VIT. FAC. VIT. CELL CRANE
900-D-2654	HOIST ELECT. FAIL REC MOD RB SLIDE ASSY ALL STL CONST. VIT. FAC. VIT CELL CRANE
900-D-2655	21598-A HOIST ELECT FAIL REC. MODULE PIN VIT. FAC, VIT CELL CRANE
900-D-2656	21546-B HOIST ELECT FAIL REC MODULE SUPPORT PLATE RB16 VIT FAC, VIT CELL CRANE
900-D-2657	21544-B HOIST ELECT. FAIL REC. MODULE SUP. PLATE RB16 VIT FAC, VIT CELL CRANE
900-D-2658	21560-A HOIST ELECT FAIL REC. MODULE SPACER VIT FAC, VIT CELL CRANE
900-D-2659	21559-A HOIST ELECT FAIL REC. MODULE SPACER VIT. FAC, VIT CELL CRANE
900-D-2660	B/M 21594 HOIST ELECT FAIL REC. MODULE RB20-36-20-L-12T-MBKT-AWC ASSY VIT FAC, VIT CELL CRANE
900-D-2661	21584-B HOIST ELECT FAIL REC. MODULE LEAD SCREW RB20 VIT FAC, VIT CELL CRANE SYS.
900-D-2662	21554-C HOIST ELECT FAIL REC. MODULE END PLATE RB20 VIT. FAC, VIT CELL CRANE
900-D-2663	B/M21593 HOIST ELECT FAIL REC. MODULE RB24-54-24-L-24T-MBKT-AWC ASSY VIT FAC, VIT CELL CRANE
900-D-2664	21548-B HOIST ELECT FAIL RECOVERY MODULE SUP. PLATE RB24 VIT FAC, VIT CELL CRANE
900-D-2665	21551-C HOIST ELECT FAIL RECOVERY MODULE SUP. PLATE RB24 VIT FAC, VIT CELL CRANE SYS.
900-D-2666	21552-C HOIST ELECT FAIL REC. MODULE RETAIN. PLATE RB24 VIT FAC, VIT CELL CRANE SYS.
900-D-2667	21565-A HOIST ELECT FAIL RECOVERY MODULE SPACER VIT FAC, VIT CELL CRANE SYS.
900-D-2668	G1B-RB-24 MOTOR BRKT
900D-4309	HLWIS EDR-CPC SHIELD DOOR WHEEL ASSEMBLY
900D-4433	HLWIS 3V-1 CRANE MODIFICATIONS ELECTRICAL SCHEMATIC-POWER
900D-4435	HLWIS 3V-1 CRANE MODIFICATIONS ELEC EQUIPMENT ARRANGEMENT
900D-4436	HLWIS 3V-1 CRANE MODIFICATIONS BLOCK DIAGRAM - ELECTRICAL

900D-4437	HLWIS 3V-1 CRANE MODIFICATIONS POWER CENTER PANEL
900D-4488	HLWIS 3V-1 CRANE MODIFICATIONS PORTABLE CONSOLE
900D-4696	Vit Facility Melter Discharge Lid Rack/Guide
900D-4750	VF TURNTABLE CANISTER PEDISTAL AND DETAILS
900D-4862	VF-Transfer Cart Powered Cart Assembly
900D-4863	VF-Transfer Cart Trailer Cart Assembly
900D-4869	VF-Transfer Cart Canister Transfer Rack Assembly
900D-4870	VF-Transfer Cart Decon Tray Assembly
900D-4871	VF Transfer Cart Charge Shoe Assembly
900D-4872	VF-Transfer Cart Vessel Frame-Tilting Assembly
900D-4873	VF-Transfer Cart Vessel Frame Cradle Assembly
900D-4874	VF-Transfer Cart Vessel Tilter Accessory Assembly
900D-4875	VF-Load Test Assembly
900D-4876	VF-24 Ton Lift Yoke Short Span Assembly
900D-4920	HLWIS 3V-1 CRANE MODIFICATION GENERAL ARRANGEMENT
900D-4921	HLWIS 3V-1 CRANE RETRIEVAL SYSTEM WINCH STAND ASSEMBLY
900D-4922	HLWIS 3V-1 CRANE RETRIEVAL SYSTEM FRAME WELDMENT
900D-4923	HLWIS 3V-1 CRANE RETRIEVAL SYSTEM ARM WELDMENT
900D-4924	HLWIS 3V-1 CRANE RETRIEVAL SYSTEM PORT ASSEMBLY AND DETAILS
900D-4925	HLWIS 3V-1 CRANE RETRIEVAL SYSTEM CARRIER ASSEMBLY
900D-4926	HLWIS 3V-1 CRANE RETRIEVAL SYSTEM CARRIER DETAILS
900D-4927	HLWIS 3V-1 CRANE RETRIEVAL SYSTEM JAW ASSEMBLY
900D-4928	HLWIS 3V-1 CRANE RETRIEVAL SYSTEM DRAWBAR ASSEMBLY
900D-4929	HLWIS 3V-1 CRANE RETRIEVAL SYSTEM DRAWBAR DETAILS
900D-4930	HLWIS 3V-1 CRANE MODIFICATIONS PARTS REMOVAL
900D-4931	HLWIS 3V-1 CRANE MODIFICATIONS CABLE ANCHOR
900D-4932	HLWIS 3V-1 CRANE MODIFICATIONS ELECTRIFICATION DETAIL
900D-4937	VIT FAC EX-CCR EAST SIDE JUNCTION BOX 68-CCTV-13-02
900D-4938	VIT FAC EX-CPC EAST SIDE JUNCTION BOX 68-CCTV-13-03
900D-4939	VIT FAC CPC OPERATING AISLE JUNCTION BOX 68-CCTV-06C-1
900D-4940	VIT FAC CPC OPERATING AISLE JUNCTION BOX 68-CCTV-06C-2

900D-4991	CONTROL WIRING DIAGRAM 3V-1 CRANE CONTROL OP AISLE TO CCR
900D-4992	HLWIS 3V-1 CRANE MODIFICATIONS EX-CELL PLC ENCLOSURE
900D-5080	HLWIS 3V-1 CRANE MODIFICATIONS ELEC PANEL INSTALLATION
900D-5081	HLWIS 3V-1 CRANE MODIFICATIONS MCP MOUNTING BRACKET
900D-5082	HLWIS 3V-1 CRANE MODIFICATIONS IN-CELL PLC SHIELDING
900D-5135	VF HLW INTERIM STORAGE RACK ASSY & INSTALLATION
900D-5136	VF HLW INTERIM STORAGE RACK, STARTER ASSY & WELDMENT
900D-5137	VF HLW INTERIM STORAGE LOWER RACK ASSY
900D-5138	VF HLW INTERIM STORAGE UPPER RACK ASSEMBLY
900D-5139	VF HLW INTERIM STORAGE COOLER RACK ASSY
900D-5155	HLWIS 3V-1 CRANE MODIFICATIONS CONTROL CONSOLE SCHEMATIC
900D-5156	HLWIS 3V-1 CRANE MODIFICATIONS INTERCONNECTIONS
900D-5239	HLWIS 3V-1 CRANE MODIFICATIONS MOTOR CONTROL PANEL
900D-5240	HLWIS 3V-1 CRANE MODIFICATIONS CABLE CARRIER DETAILS
900D-5241	HLWIS 3V-1 CRANE MODIFICATIONS IN-CELL PLC ENCLOSURE ASSY
900D-5242	HLWIS 3V-1 CRANE MODIFICATIONS IN-CELL PLC PANEL ASSY
900D-5243	HLWIS 3V-1 CRANE MODIFICATIONS IN-CELL PLC PANEL DETAIL
900D-5244	HLWIS 3V-1 CRANE MODIFICATIONS DRAWING LIST
900D-5245	HLWIS 3V-1 CRANE MODIFICATIONS FESTOON DETAIL
900D-5247	VF TRANSFER CART CONTROL MODULE SUPPORT FRAME ASSEMBLY
900D-5249	VF BOOM FOR RECOVERY CART POWER CABLE ASSEMBLY & DETAILS
900D-5255	VF RECOVERY CART ASSEMBLY
900D-5256	VF RECOVERY CART LOAD TEST BRACKET ASSEMBLY
900D-5262	VF BOOM FOR RECOVERY CART POWER CABLE INSTALLATION
900D-5260	VF PUREX Electrical Connector Dust Cover Assembly
900D-5263	VF PUREX Nozzle Dust Cover Assembly
900D-5266	VF LOAD TEST STORAGE CRADLE ASSEMBLY
900D-5299	VF TRANSFER CART SYSTEM PLANT ARRANGEMENT
900D-5312	VF 2" Blank PUREX Connector Assy
900D-5313	VF 2" Blank PUREX Connector Details
900D-5333	VF TRANSFER CART STAND FOR LIFTING YOKES ASSEMBLY

900D-5340	VF TRANSFER CART LIFTING YOKES & STAND ARRANGEMENT
900D-5367	Vit Facility Melter Discharge Lid Rack/Guide
900D-5381	VF GRAPPLE LIFTING ADAPTOR HOOK ASSEMBLY
900D-5395	VF 24 Ton Lifting Yokes 90• Adapter Hooks
900D-5395	24-TON LIFTING YOKES 90 DEG. ADAPTER HOOKS
900D-5664	VF EDR Crane 15V-21 Elementary Diagram
900D-5748	VF Transfer Cart Evacuated Canister Assembly Rack
900D-5783	HLWIS 3V-1 CRANE MODIFICATIONS 16 TON RAIL EXTENSIONS
900D-5800	VF MANIPULATOR TONG CHANGE FIXTURE
900D-5903	VF Load-In Building Canister Load-In General Arrangement
900D-5904	VF Load-In Building Canister Load-In Sections
900D-5905	VF Load-In Building Canister Load-In Penetration Installation
900D-5906	VF Load-In Building Canister Load-In Penetration Sections & Details
900D-5907	VF Load-In Building Canister Load-In Transfer Rack Assy
900D-5908	VF Load-In Building Canister Load-In Receiver Rack Assy
900D-5909	VF Load-In Building Canister Load-In Brush Seal Half Assembly
900D-6025	VF IMPACT WRENCH LIFT ADAPTOR ASSEMBLY AND INSTALLATION
900D-6027	HLWIS - 16 TON TROLLEY
900D-6034	CPC 3V-2 PAR REPLACEMENT GIRDER NORTH DETAIL
900D-6035	CPC 3V-2 PAR REPLACEMENT GIRDER SOUTH DETAIL
900D-6036	CPC 3V-2 PAR REPLACEMENT GIRDER INSTALLATION
900D-6143	VF CANISTER TEMPORARY LID HANDLER DETAILS
900D-6204	VF CANISTER GRAPPLE HANDLED BUCKET
900D-6277	VF Melter Thermocouple Handler Assembly
900D-6435	VF Transfer Cart Evacuated Canister Assembly Rack Installation
900D-6491	VF WASTE HANDLING LAN ASSEMBLY AND DETAILS
900D-6497	VF EDR Radiation Probe Assembly
900E-4576	EDR - CPC SHIELD DOOR GENERAL ARRANGEMENT
905D-030	GA VITRIFICATION FACILITY PLAN EL 100'
905D-031	GA VITRIFICATION FACILITY EDR, CPC PLAN EL 100'

905D-032	GA VITRIFICATION FACILITY PLAN EL 110.25'
905D-033	GA VITRIFICATION FACILITY EDR CPC PLAN EL 117'
905D-034	GA VITRIFICATION FACILITY PLAN EL 124' & ABOVE
905D-035	GA VITRIFICATION FACILITY EDR, CPC PLAN EL 131'
905D-036	GA VITRIFICATION FACILITY SECTIONS
905D-037	GA VITRIFICATION FACILITY SECTIONS
905D-038	GA VITRIFICATION FACILITY SECTIONS
905D-039	GA VITRIFICATION FACILITY SECTIONS
905D-040	GA VITRIFICATION FACILITY PLAN EL 146.25' & ROOF
905O-	Bartholomew Series
9152 -	Series drawings from Hot Cells Services, Vendor #8008
9985 -	Series drawings from Kranco, Vendor #11004
Q-6340 -	Series drawings from ORNL, Vendor #15004
VP-4413-15-M-8-	Series drawings for Corning windows
VP-4413-15-V-77	20-Ton Crane with (2) 10 Ton HG, 10B Hoists
VP-4413-M-17	Zinc Bromide Window for 3'-0" Wall
X3E020097A	Series drawings from ORNL, Vendor #15004
280-932-49	BISCO Series, Shield Doors
3B-P-1056	EDR 20 Ton Crane with (2) 10 Ton Hoists Bridge Wiring
3B-T-1006	CCR Viewing Window Sub Frame
3-P-1 - 3-P-37	CPC Lights
63-M-001-15	Schematic Diagrams for Doors 63-M-001, 63-M-003, and 63-M-008
> 900D-5042	VF Canister Temporary Cover
> 900D-6720	VF Impact Wrench Right Angle Drive Adapter
> 900D-6732	VF Impact Wrench Socket Extension Adapter
> 900D-6584	VF CFM and MFHT Adapter Gearbox Lube Fixture
> 900D-6730	VF Remote Gasket Removal Tool

APPENDIX B - Transfer Cart

1.0 DESIGN REQUIREMENTS

The design of the transfer cart shall include the following:

- The cart frame(s)
- Drives complete with motors, gearboxes, and wheels
- On-cart battery module
- On-cart control module
- Rail stops for both ends of the rail
- Failed cart retrieval system
- Battery charging system
- Battery disposal plan
- Canister support rack
- Miscellaneous item transport tray
- Attachments for large equipment handling
- Conceptual design of fixtures for large equipment handling
- Control transmission devices
- Control and power distribution system
- Procurement package
- Operating, troubleshooting, and maintenance procedures
- Vendor test plan
- WVNS cold test plan

1.1 Mechanical

The transfer cart shall be designed to move a load of four 100% filled canisters (10.4 tons) plus the cart dead load from the VC to the CPC without undue effort. Additional provisions for loads up to 25 tons shall be provided by the use of trailer carts to handle vessels and load test weights.

The transfer cart shall be designed for decontamination activities which cleans the cart exterior without harm to the structure or components.

The existing rail design from the VC to the CPC shall be used.

The cart shall be sized to pass through all of the existing door openings.

Due to the extremely low likelihood of a loaded transfer cart being in the VC during a seismic event, no seismic restraint is required.

The cart shall be designed for remote removal in the event of drive or control failure.

The cart shall be designed for individual drives for all four drive wheels. This is intended to increase redundancy while decreasing maintenance difficulties.

The cart shall be designed to accommodate the mounting of all required on-board electrical equipment.

The cart shall be designed with one bolting/attachment interface which will be used to mount various racks, trays, and fixtures.

The cart shall be remotely operable from various ex-cell positions using general area remote CCTV and shielded viewing windows. No CCTV cameras or monitors are required in the transfer cart design.

Sweeps shall be provided in front of wheels to provide clear passage of wheels.

Bumpers shall be provided to reduce impacts against rail stops and shield doors.

Lifting provisions shall be provided for cart removal in the EDR and the CPC using vessel handling strong-backs (yokes).

1.2 Electrical

The cart shall be battery powered with no trailing umbilicals.

The cart shall be capable of having the battery pack recharged without removing it from the cart. The charging location will be a permanent installation in the EDR. The connection and disconnection shall be automatic as the transfer cart passes through the charging location. Charging controls and power supply will be located in the EDRVA.

The cart shall have a battery pack designed and wired so that it can be removed and reinstalled remotely.

The battery pack shall be designed such that it can be removed from its container and disposed of as nonradioactive waste.

The cart shall have the battery pack instrumented to remotely indicate the state of battery charging and discharging.

The cart shall be designed to mount the necessary on board electrical controls in an enclosure that can be removed and reinstalled remotely.

The cart shall be designed to be wired in a fashion that permits remote removal of modules. Wiring runs shall be captured and positioned such that they are not susceptible to damage, be amenable to decon activities without damage, and be able to withstand the radiation fields without degradation.

The electrical system shall be sized to accommodate all the individual drive motors operating simultaneously.

1.3 Controls

The cart control system shall be designed to accommodate the already existing penetrations for antenna placement.

The cart shall have capability to detect over/under current draw for the drive motors and be remotely reset if required.

The system shall be designed to meet all of the requirements of WVNS-DC-011 and the additional requirements stated in this section.

1.4 Environmental

The radiation field is 10,000 r/hr in the cell in close proximity of the canisters and diminishes to approximately 0.010 r/hr at the charging location.

Temperature will range from 20 degrees to 120 degrees Fahrenheit.

Relative humidity will range from 10 to 90 percent.

1.5 Remote Maintenance

Any change-out of cart components will be done with the aid of an overhead crane and an impact wrench. Replaceable components shall be designed accordingly.

Any activities requiring hands on contact maintenance shall be limited to the EDR area.

The drive wheel assemblies shall be capable of being removed and replaced while the cart is on the rails. Some slight jack-up may be required.

1.6 Materials

The metals for all in-cell equipment shall resist a decontamination process satisfactorily. The use of stainless steels is preferred, however, an appropriate paint may be used to protect carbon steel where required.

No uncontained organic materials shall be used on the cart.

Wires and electrical components shall resist the radiation exposure or be shielded to provide a life of five years in the Vitrification Facility.

No carbon steel shall be left without surface protection against corrosion except for the wheel outside diameter touching the rails.

1.7 Radiation and Safety

All materials used on the cart shall be designed for five years of operation without maintenance in a radiation environment resulting from the anticipated integrated dose. Where this requirement results in excessive costs, application of standard equipment designed for remote changeout will be considered. Total accumulated dose goal is 10e7 R.

The charging location design shall consider a field of 0.010 R/hr and will be exposed to intermittent spikes of exposure when the cart passes the station location and when the EDR/CPC shield door is open.

1.8 Structural

All welding shall be in accordance with ASME code section IX or AWS D1.1. Structural welds shall be nondestructively examined.

The main frame shall be tubing or fabricated box sections.

The completed assembly shall be operationally tested to determine the power to load relationship.

1.9 Maintenance and Inspection

The system shall be designed to operate a minimum of five years without maintenance.

The individual wheel drive units shall be replaceable with a minimum of effort and tools. The replacement will occur in an area where personnel can enter; however, the design shall be such as to minimize their time.

Maintenance may be performed in different areas; EDR, maintenance station, Chemical Crane Room (CCR), master slave manipulator repair room, or in the Crane Maintenance Room (CMR). Any removed module could be worked on in these areas. Depending on the level of decontamination, the area for maintenance will be selected from the above. In any event, the design of the equipment should address maintenance activities using MSMs, overhead cranes, impact wrenches, and the like.

Appropriate bails should be designed to accommodate lifting of modules with crane hooks.

1.10 Instrumentation and Controls

All instrumentation required for operation and control of the cart shall be in accordance with Instrument Society of America ISA-S5.1-73.

The charging system shall have its instrumentation designed and built into a permanent charging module ex-cell. It shall shut itself off once full charge is obtained unless it is demonstrated that continuous charging is neither unsafe nor detrimental to battery life.

Two control stations to operate the cart shall be provided. One station shall be located on the north wall of the VC and an additional station shall be provided at the north CPC viewing window. Interlocks shall be provided to use one station at a time and not permit the cart to be operated from both stations at the same time.

All control switches shall be spring return to off.

Interlocks shall be provided to ensure that the transfer cart cannot be moved while any of the following doors are being moved:

- The transfer tunnel door (63M-001)
- The transfer tunnel to EDR door (63M-008)
- The EDR/CPC shield door (3M-3)

Interlocks shall be provided to ensure that the following doors cannot be moved while the transfer cart is being moved:

- The transfer tunnel door (63M-001)
- The transfer tunnel to EDR door (63M-008)
- The EDR/CPC shield door (3M-3)

A logic function shall be provided which sounds an audible warning when the transfer cart is being driven towards any shield door that does not have a "door fully open" limit switch set.

Battery voltage shall be monitored over the remote control data transmission system.

Motor current shall be monitored over the remote control data transmission system for all four drive motors.

Two auxiliary remotely controlled power outlets shall be provided to allow use of DC powered tools from the transfer cart. The power outlets shall be the same as the connections for the four independent drive motors to provide built-in spares.

Basic controls shall provide for controlled cart movement in either direction.

Brakes shall only be included if friction loses are not sufficient to stop the cart within distance in feet equal to 10% of the rated load speed in feet/minute.

Enclosures shall be in accordance with the National Electric Code.

All on-board cart controls shall be modularized as much as possible and be capable of remote removal as a unit using only the overhead crane and impact wrench.

1.11 Codes and Standards

The following codes and standards are applicable to the design and fabrication of the Transfer Cart:

- Symbols for welding and nondestructive testing; AWS A.2.4
- Drafting; ANSI Y 14.5
- Structural; AISC latest revision
- Electrical; National Electrical Code
- Instrumentation; Instrumentation Society of America, ISA-S5.1
- Machined surfaces; ANSI B46.1
- Materials; ASTM
- Painting; ANSI N5.12 (SPCC-10)

1.12 Quality Assurance

The West Valley Project Quality Assurance Program Plan shall apply. This quality assurance program is in accordance with ANSI/ASME NQA-1. Oak Ridge National Laboratory's quality assurance manual shall be used for the control/electrical system design portion.

Acceptance testing of transfer cart components will be required at the fabricators.

1.13 Interfaces

The system will interface with the following:

The existing rail system in the CPC, and a new track in the transfer tunnel and the VC.

The cart must pass through the following shield door openings:

63-M-001-1C Transfer Tunnel Shield Door Installation Drawing
63-M-001-2C Transfer Tunnel Shield Door Installation Drawing
63-M-008-1C Transfer Tunnel to EDR door 63-M-008 Installation
VF-4413-15-M-9-B-12-4 Installation CPC Shielding Door
VF-4413-15-M-9B-1-0 Frame - Door

Crane hooks:

Hook	Crosby-Laughlin #
VC main	319C-PC
VC process	319C-KC
EDR (2 hooks)	319C-LC
CPC-16	319C-OC
CPC-2 (2 ea.)	319C-HC

The EDR/CPC floor load capacities are on drawing 15A-Q-26-R4.

2.0 OPERATION OF TRANSFER CART

Normal operation of the transfer cart system is to move empty canisters into the VC and move full canisters from the VC to the CPC. To do this, the following steps are required:

1) A rack that has capability of carrying four canisters will be installed on the frame of the cart.

2) The operator opens the transfer tunnel door (63M-001). The operator moves the cart to the north end of the rails in the VC. The operator then closes the transfer tunnel door.

3) An operator loads canisters into the rack from an interim storage rack in the VC pit using the VC crane. This operation could take as much as two hours.

4) The operator opens the transfer tunnel door (63M-001). The operator moves the cart to the transfer tunnel and stops it. The operator closes the transfer tunnel door and then opens the transfer tunnel to EDR door (63M-008). The operator would then move the cart to the EDR and stops it. The operator closes the transfer tunnel to the EDR door. The operator opens the EDR/CPC shield door (3M-3) and moves the transfer cart into CPC. Once the cart is in the CPC, the EDR/CPC shield door is closed.

   During this time the operator could move about to the various viewing positions as necessary or the CCTV system could be utilized.

5) An operator unloads canisters using the CPC crane until the cart is empty. The operator moves the cart back to the charging location in the EDR and closes all shield doors.

6) The charging location shall be located in the EDR where viewing of the cart is possible using the EDR crane mounted CCTV. The cart would remain at the charging location until called upon for further service. The charging location and the empty canister loading station should be at the same location if possible.

7) When moving new empty canisters into the cell, the operator would load four empty canisters into the rack. After loading, the cart would move into the VC and get unloaded after which it would be moved again to the charging location.

8) When it is necessary to move equipment other than the canisters, a new fixture(s) would be required in lieu of the rack. In this event, the cart would be moved to either the CPC or the EDR where rack removal and fixture installation would occur. The attachment of the rack and fixtures would be accomplished by the overhead crane and the use of the impact wrench, although contact operations may also be required.

9) In the event of failure, suitable features will be required to support a retrieval system. The cart must be able to be removed in the event of a power failure or similar event. The retrieval system must be capable of recovering a failed cart with a load of four filled canisters either to the VC or the CPC with all cart wheels locked. Once the canisters are removed from the cart the cart must be recovered to the EDR for repairs by manned entry. No manned intervention into the EDR or the transfer tunnel will be allowed to initiate recovery operations.

10) When the spring return control switch is released and power is shut off to the drive wheels, the cart should stop within six inches at maximum speed with a full canister load.

2.1 Transfer Cart Limitations

The transfer cart battery charge cycle limits the time the cart may spend away from the charge station to approximately 10 Hrs.

The emergency kill switch on the transfer cart pendants should only be used during a true "Runaway." Once the kill switch is used there is no way to restart the cart control system without returning it to the charge station. Transfer cart recovery operations would have to be undertaken to return the cart.

The transfer cart depends on two antennas to assure that a signal null will not strand the cart. The cart should not be operated without both antennas functioning correctly.

Transfer cart operations must be observed either through shield windows or by CCTV. The cart shall not be operated "blindly."

The load test assembly actuators are not accessible from the east side in the EDR due to crane bridge travel limits. Weights should, therefore, be stacked in even increments so the actuator on the west side may be used. To obtain an odd total weight, place the odd addition on the stack last so that the actuator does not have to be operated again once it is on the cart.

APPENDIX C - In-Cell Canister Storage Rack

1.0 DESIGN REQUIREMENTS FOR IN-CELL CANISTER STORAGE RACK

1.1 Functional Requirements

The canister storage rack shall be capable of supporting and holding (storing) a minimum of five canisters in a vertical position. The canisters may be empty or full. The storage rack shall maintain the canisters in a vertical position.

The storage rack shall be capable of remote installation to and removal from the VC using the overhead crane and impact wrench.

The canister storage rack shall be located within the VC in the turntable pit to the south of the turntable.

The canister storage rack shall be capable of being lifted remotely with the following overhead cranes; the VC backup crane, the EDR crane, and the CPC crane. Only empty canisters may be left in the storage rack during lifting. A single point lift shall be used.

Any surfaces of the canister storage rack that may contact the canister shall be of stainless steel and be free of paint and sharp edges.

The canister storage rack shall be designed with a remote mounting/bolting attachment interface for the in-cell maintenance station.

The canister storage rack shall not interfere with operation of the turntable and its jumpers.

The storage rack shall be designed to support a load consisting of 100% filled canisters (weighing 5,200 lbs. each) at each holding position. When the canister storage rack is empty, not containing canisters, it shall support the in-cell maintenance station weight of 10,000 lbs.

The canister storage rack shall minimize its surface contact area to the canister. Sharp internal or external edges and corners that may contact the canister are not permitted.

The canister storage rack shall allow canisters to be placed into and removed from its structure using the grapple attached to the VC process crane.

The storage rack shall be covered or allow lids to be remotely installed onto and removed from canisters.

The canister storage rack shall pass through the following shield doors, when being moved on the transfer cart; VC to Transfer Tunnel door, transfer tunnel to EDR door, EDR to CPC door. The maximum height of the storage rack shall be 13 feet.

1.2 Operational Requirements

During normal operations, the canister storage rack is used to store empty canisters awaiting filling and full, capped, and decontaminated canisters awaiting removal from the Vitrification Cell. Due to process or equipment problems, the canister storage rack may also be required to store canisters in various stages of the process, such as partially filled, uncapped, or awaiting decontamination.

The transfer cart will bring four empty canisters into the cell. The operator using the process crane and grapple removes one empty canister from the transfer cart and places it into the canister storage rack. The operator then removes one full canister from the storage rack and places it into the transfer cart. After all canisters have been moved, the transfer cart leaves the cell with four full canisters. Canisters will be moved from the storage rack to the turntable, weld station, decon station and returned to the storage rack as required by the process.

The Maintenance Station structure may be remotely mounted onto the canister storage rack to allow specific maintenance tasks to be performed. All canisters held in the storage rack must be removed, to prevent contamination with organic materials, prior to installing the maintenance station onto the storage rack. After completion of the maintenance activity, the maintenance station structure is remotely removed from the canister storage rack.

In the event of a failure of the turntable or melter, the in-cell canister storage rack must be removed remotely using the impact wrench and overhead crane and placed on the transfer cart. The storage rack is removed from the cell and moved through the transfer tunnel to the EDR or to the CPC using the transfer cart. In the EDR, the rack may be removed remotely from the transfer cart using the EDR crane. In the CPC, the storage rack may be removed remotely using the CPC crane. Only empty canisters may be left within the storage rack during removal of the rack from the Vitrification Cell.

1.3 Environmental Requirements

The storage rack shall be able to withstand a radiation field of 11,000 R/HR gamma radiation at the surface of the canister. the annual integrated dose may reach 1 x 10*8 RAD.

The storage rack shall be able to withstand an atmosphere where air temperature may vary from 50 to 120 degrees F and humidity up to 95% RH (noncondensing). The cell may have as much as 100 PPM nitric acid fumes during off normal conditions.

The canister storage rack, when empty (not containing canisters) may be sprayed with high-pressure water at 1000 psi maximum pressure.

1.4 Remote Maintenance

The canister storage rack shall be capable of installation to and removal from the Vitrification Cell using only the overhead crane and impact wrench. A single point lift shall be used.

The canister storage rack shall be capable of transportation into or out of the cell using the transfer cart.

1.5 Material Requirements

Any surfaces of the canister storage rack that may contact the canister shall be 304L stainless steel and be free of paint and sharp edges.

The metal for the rack shall resist a decontamination process. Stainless steel is preferred, although carbon steel protected with an appropriate paint may be used. All carbon steel surfaces shall be protected against corrosion.

The surface finish of the canister storage rack, except for welds, shall not exceed a maximum average roughness of 125 microinches. All welds shall not exceed a maximum average roughness of 250 microinches (per ANSI B46.1).

1.6 Radiation and Safety

The canister storage rack shall not permit internal or external corners or edges that may contact the canister. Internal or external pockets may trap and contain radioactive contaminants shall be minimized. The design shall facilitate decontamination wash down and wiping off by eliminating sharp edges and protrusions which could tear plastic clothing and gloves.

The canister storage rack design shall minimize cracks and crevices between bolted mounting surfaces that could trap radioactive contaminants or decontamination fluids. All welds shall be continuous. Stitch welded is prohibited.

1.7 Maintenance and Inspection

The canister storage rack shall be designed to not require maintenance.

1.8 Quality Assurance

Acceptance load testing will be required at the fabricators.

1.9 Codes and Standards

The following codes and standards are applicable to the design and fabrication of the In-Cell Canister Storage Rack:

- Symbols for welding and nondestructive testing - AWS A.2.4
- Drafting - ANSI Y14.5
- Structural - AISC
- Structural Welding AWS D1.1 or ASME Section IX for stainless steel.
- Machined surfaces - ANSI B46.1
- Materials - ASTM
- Painting - ANSI (SPCC-10)

1.10 Interfaces

The VC process and backup cranes and hooks per 900D-2670.

The impact wrench per 900D-2555.

The canister per 900D-1092.

The In-Cell Maintenance Station.

The grapple per E2034-1000.

The transfer cart.

The CPC crane and hook (Crosby #319C-OC).

The storage rack must pass through the following shield doors:

VC to transfer tunnel (63-M-001C and 2C)
Transfer tunnel to EDR (63M-008-1C)
EDR to CPC (VP-4413-15-M-9-B-12-4 and VP-4413-15-M-9B-1-0).

The EDR crane and hook (Crosby #319C-LC).

2.0 LIMITATIONS

2.1 Canister Storage

Canisters shall be stored only in approved racks to reduce possibility of damage from toppled canisters. Approved racks include the In-Cell rack, the turntable, the weld station, the decon station, the transfer cart, and the CPC storage racks.

APPENDIX D - Performance Test Requirements

1) Door 63-M-001 Seismic Latch Control System Performance

Purpose: Demonstrate that the control/mechanical drive systems are capable of positioning the door precisely enough to assure the seismic latches can be driven in.

Method: Fully open the door, close the door, and insert the latches repeatedly without failure.

Acceptance: 20 successive operations without failure.

2) Door 63-M-008 Seismic Latch Control System Performance

Purpose: Demonstrate that the control/mechanical drive systems are capable of positioning the door precisely enough to assure the seismic latch can be driven in.

Method: Fully open the door, close the door, and insert the latches repeatedly without failure.

Acceptance: 20 successive operations without failure.

3) Crane 3V-1 16-Ton Hoist Accessibility to the West Canister Rack Position

Purpose: Demonstrate that the crane as extensively modified is capable of positioning directly over the West opening. There is no adequate way of verifying this requirement without a test.

Method: Position a small fixture into the west-most canister position of each rack to assure variations in cell concrete to not interfere.

Acceptance: Position fixture in all west canister positions.

4) Melter Discharge Lid/Heater Installation/Removal Equipment Performance

Purpose: Demonstrate that the equipment designed to remove and install is capable of performing remote installation/removal without damage to the heater bars.

Method: Perform remote change-out of Discharge Lid.

Acceptance: Successful change-out without heater damage.

5) Melter Feed Jumper Change-Out

Purpose: Demonstrate that the melter feed jumper can be remotely replaced. This jumper is difficult to handle and is likely to require change-out.

Method: Perform remote change-out of Feed Jumper.

Acceptance: Successful change-out without jumper damage.

6) Melter Off-Gas Jumper Change-Out

Purpose: Demonstrate that the Melter Off-Gas Jumper can be remotely replaced. This jumper is difficult to handle and is likely to require change-out.

Method: Perform remote change-out of Off-Gas Jumper using a single hook.

Acceptance: Successful change-out without jumper damage.

7) Melter Off-Gas Cleaner Change-Out

Purpose: Demonstrate that the Melter Off-Gas Cleaner can be remotely replaced. This device is difficult to handle and is likely to require change-out.

Method: Perform remote change-out of Off-Gas Cleaner.

Acceptance: Successful change-out without damage.

8) Melter Off-Gas Cleaner Failure Recovery

Purpose: Demonstrate that the Melter Off-Gas Cleaner can be recovered after failure.

Method: Perform remote recovery of Off-Gas Cleaner.

Acceptance: Successful recovery without damage.

9) Melter Thermocouple Change-Out

Purpose: Demonstrate that the Melter Thermocouples can be remotely replaced. The thermocouples are extremely important to melter operations and will require periodic change-out.

Method: Perform remote change-out of thermocouples.

Acceptance: Successful change-out within one hour of change-out decision.

> **10) Test Deleted**

11) Door 63-M-002 Control System Synchronization

Purpose: Demonstrate that the system used to keep the door hoists synchronized is capable of recovering from an upset.

Method: Force the door out of synchronization and allow the control system to automatically bring it back.

Acceptance: Automatic realignment of door.

12) Door 63-M-002 Control System Power Failure Response

Purpose: Demonstrate that the system used to keep the door hoists synchronized is capable of recovering from a power outage.

Method: Force a power outage during door operation and allow the control system to automatically bring it back.

Acceptance: Automatic realignment of door.

13) Process Crane Bridge Power Track Cable Replacement

Purpose: Demonstrate that a failed cable can be replaced. During the design review of this crane, a major concern was difficulty of replacing a failed cable. A full scale test was proposed as a solution to this concern. This test has not been performed.

Method: Use an existing cable to pull a new cable through the power track.

Acceptance: Pulling a new cable into the power track with no cable damage and no manned entry into the Vitrification Cell.

14) Transfer Cart/Track Obstacles and Interference Check

Purpose: Demonstrate that there are no obstructions on the cart track-way which stop the cart.

Method: Place 10-ton load on cart and traverse entire trackway

Acceptance: No unplanned stops due to obstructions.