Attachment A
CC:94:0047

Instructions for Updating the Contents of the Vitrification Facility NRC Readiness Notebook Volumes I, IV, V

Attached you will find one drawing list, one drawing package, and three system descriptions. Please follow the instructions detailed below to update Notebook Volumes I, IV and V. Note that the vertical lines appearing to the left of the drawing number on the drawing lists indicate the drawings to add or replace in your NRC Readiness Notebook.

In Section 1.2: P&IDs, of your NRC Notebook, replace the list of P&ID drawings, dated 3/24/94, with the attached list of drawings titled, Section 1.2: P&IDs, dated 4/28/94.

The drawings in your package will go into this section behind the drawing list. Drawing numbers, names, and number of sheets per drawing are identified in the title block which appears on the bottom right corner of each drawing. Carefully match the drawing numbers (paying particular attention to the number of sheets per drawing) to the drawings in your NRC Notebook and replace each drawing with its updated version. Drawings should be added in the sequence indicated on the drawing list.

After you have completed adding or replacing drawings, you may wish to compare the drawing list included in the front of section, 1.2: P&IDs, to the actual order of drawings in your NRC Notebook.

In Volume IV of your notebook series, add the Vitrification Facility Electrical Power Distribution System Description, System 63ED, behind the Section 1.4.14 tab. Next, add the Vitrification Facility Steam and Condensate System Description, System 63SC, behind the Section 1.4.19 tab.

In Volume V of your notebook series, add the Vitrification Facility Sample Transfer System Description, System 69B, behind the Section 1.4.30 tab.

The Table of Contents in the front of each volume may be used to verify the correct sequence of documents.

VSE/1349JAE

Vitrification Facility NRC Readiness Notebook Transmittal Schedule

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	Cold Chemical System	07/16/93	7/16/93
	Vitrification	06/30/94	
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1.3	General Arrangement Drawings		
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1.3.3	High Level Waste Interim Storage (CPC & EDR)	07/16/93	7/16/93
1.3.4	Ex-Cell Off-Gas Areas of the 01-14 Building	07/16/93	7/16/93
1.4	System Descriptions		
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1.4.5	63I - Vitrification Main Process	11/01/93	
1.4.6	63J - Canister Decontamination	01/16/94	8/30/93
1.4.7	63K - In-Cell Remote Handling, Maintenance and Viewing	TBD	
1.4.8	63L - Canister Welding	06/15/94	2/25/94
1.4.9	63M - Vitrification Load In & Load Out	TBD	
1.4.10	63P - Vitrification Process Chemistry	TBD	
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1.4.12	63DV - Vitrification Drain, Waste, Vent (Sanitary)	TBD	
1.4.13	63DW - Vitrification Demineralized Water	11/01/93	11/30/93
1.4.14	63ED - Vitrification Electric Power Distribution	04/30/94	4/29/94
1.4.15	63FO - Fuel Oil	09/30/94	
1.4.16	63FP - Fire Detection and Protection	11/01/93	
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2.1	ORR Plan	07/30/93	7/30/93
2.2	ORR Tree		
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4.1	Test Program Plan (WVNS-TPL-63-001)	07/30/93	7/30/93
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Note: Shaded sections have been previously transmitted or are included with this transmission.

Rev. 04/27/94

West Valley Demonstration Project

Doc. Number WVNS-SD-63ED

Revision Number 0

Revision Date 03/29/94

SYSTEM DESCRIPTION

VF ELECTRICAL POWER DISTRIBUTION

PREPARED BY S. Palit 3-23-94 S. Palit
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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
- Placing the words GENERAL REVISION at the beginning of the text
- Placing either FC#> or PC#> at the beginning of a field/page change

Example:

The arrow in the margin indicates a change. >
The vertical line in the margin indicates a change. |

Rev. No.	Description of Changes	Revision On Page(s)	Dated
0	Original Issue	All	03/29/94

WVNS RECORD OF REVISION CONTINUATION FORM

Rev. No.	Description of Changes	Revision On Page(s)	Dated

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LIST OF ACRONYMS

A	Ampere
AC	Alternating Current
AHU	Air Handling Unit
BkR	Breaker
CC	Cold Chemical
CCTV	Closed Circuit Television
°C	Degree Celsius
CMR	Crane Maintenance Room
CMS	Communication
CWD	Control Wiring Diagram
DC	Direct Current
DCS	Distributed Control System
DOE	Department of Energy
EDS	Electrical Power Distribution System
FA	Forced Air (Cooling)
GA	General Arrangement
HP	Horse Power
HVAC	Heating Ventilation and Air Conditioning
Hz	Cycles per second
I	Instantaneous
ILDS	Infrared Level Detection System
IR	Instrument Rack
IWP	Industrial Work Permit
KA	KiloAmperes
Km	Kilometer
kV	Kilo Volt
kVA	Kilo Volt Ampere
LP	Lighting Panel
LT	Long Time
MCC	Motor Control Center
MCCB	Molded Case Circuit Breaker
MVS	Melter Viewing System
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NMPC	Niagara Mohawk Power Corporation
OA	Self Cooled
ph	Phase
PLC	Programmable Logic Controller
PM	Preventive Maintenance
PP	Power Panel
PVS	Plant Ventilation System
QA	Quality Assurance
QC	Quality Control

LIST OF ACRONYMS
(cont)

RWP	Radiation Work Permit
SDG	Standby Diesel Generator
SFCM	Slurry Fed Ceramic Melter
SOP	Standard Operating Procedure
ST	Short Time
STS	Supernatant Treatment System
UL	Underwriter's Limited
UPS	Uninterruptible Power Supply
V	Volts
VF	Vitrification Facility
WCC	Work Control Center
W	Westinghouse
WVNS	West Valley Nuclear Services

SUMMARY

The Vitrification Facility (VF) Electrical Power Distribution System (EDS), designated as System 63ED, receives electrical AC power from the off-site utility. The off-site AC power is stepped down to lower voltage and is distributed to all VF systems located in the VF, Cold Chemical, and Fuel Oil Storage Building. The EDS also distributes power from the on-site Standby Diesel Generator (SDG) to selected loads of the VF system in the event of loss of off-site utility power.

VF ELECTRICAL POWER DISTRIBUTION

1.0 FUNCTIONS AND DESIGN CRITERIA

1.1 Functions

The Vitrification Facility (VF) receives normal AC power from the Niagara Mohawk Power Corporation (NMPC) off-site utility system at the 34.5 kV level. The Electrical Power Distribution system (EDS) steps down this 34.5 kV level to the 480V level which is further stepped down to 240/120V and 208/120V levels to feed various VF systems loads. The EDS also includes the on-site SDG and the Uninterruptible Power Supply (UPSs) which provides power to selected loads according to the tables (Appendix B, C, D, and E) in the event of loss of the off-site utility system.

Specific functions include:

1.1.1 Receives 34.5 kV three-phase 60Hz power from the NMPC off-site utility system.

1.1.2 Provides on-site normal AC power by stepping down the 34.5 kV voltage for distribution of auxiliary power at 480V, 240/120V and 208/120V levels to various VF systems.

1.1.3 Upon loss of off-site utility power, provides on-site standby diesel power generation of sufficient capacity to supply selected loads (Appendix B) for extended power outages. The exhaust fan, off-gas heaters, lighting panel, power to fuel oil storage, backup power to UPSs, control room unit heaters, and the power panel supplying Radiation Monitoring System are considered as selected loads.

1.1.4 Provides power to monitoring system through UPSs (Appendix C, D, and E).

1.1.5 Provides adequate instrumentation, control, and protection with features to permit operation of electrical system equipment during fault conditions (i.e., occurrence of overload, undervoltage, and/or short circuit).

1.1.6 Provides adequate power capacity and voltage for all loads to permit normal starting and operation of VF Systems equipment.

1.2 Design Requirements and Design Criteria

1.2.1 General Requirements

The one-line diagrams for 480V substation A and B, 480V switchgear A1 & A2, 480V motor control centers (MCC), show the power panels (PP) and lighting panels (LP). Circuit schedule drawings show the design criteria for the VF system regarding bus ampere ratings, bus short circuit levels, breaker frame sizes including its short circuit rating, sizes of connected loads, and cable sizes.

The following is a discussion of the general design requirements for the EDS structure, configuration, maintenance, surveillance, interfaces with other systems, quality assurance, codes and standards, and instrumentation and control.

1.2.2 Structural Requirements

A. Mechanical Design Conditions

The EDS components are designed to withstand the stresses generated by electrical transients like overload, short circuit, and voltage swing that may occur during fault conditions.

B. Seismic Requirements

All EDS equipment and support between Col. 5 and 6 (Dwg. 905-D-030) will maintain structural integrity and remain functional during and after the postulated occurrence of the seismic event per the requirements specified in the purchase or construction specification.

C. Material Requirements

The EDS construction materials were selected on the basis of performance proven in the industry, latest state-of-the-art technology, and suitability for the environment for which they are installed.

1.2.3 Safety and Reliability Requirements

A. Safety

1. The EDS is designed with physical barriers and electrical interlocks to reduce hazards to personnel and damage to equipment during normal operation, maintenance, and emergency shutdown of the VF.

2. Electrical ground connections are applied to the electrical equipment to enhance personnel safety. In general all motors and control stations have disconnect switches located within sight, to provide disconnecting means for maintenance. The disconnecting means, both at the MCC or the disconnect switch located near the load, are capable of being locked in the open position.

B. Reliability

The VF EDS components are designed, based on safety class, service class, and quality level defined in WVNS-DC-022 for a reliable operation of the facility.

1.2.4 Maintenance and Surveillance Requirements

A. The EDS is designed to facilitate the replacement and repair of failed parts including assemblies and subassemblies. Where practical, means are provided to maintain the EDS equipment without having to shut down the whole system.

B. Where practical, interchangeability and standardization are used for parts, materials, and equipment such as electrical circuit breakers, relays, and motor starters. This minimizes the need for large spare parts inventories.

C. The EDS layout and design incorporate the necessary features to provide for periodic inspection and maintenance. The design includes adequate space inside equipment for inspection and maintenance. Inspection and maintenance procedures provide maximum safety for personnel and for system operation.

D. The detailed and specific maintenance requirements of the EDS will be provided in the EDS Standard Operating Procedures based on the manufacturer's maintenance manual and industry standards.

1.2.5 Interfacing System Requirements

The EDS distributes power and control to all VF systems located in the VF, Cold Chemical, and Fuel Oil Storage Building. Appendix F lists the electrical interfaces between the VF EDS and other systems.

1.2.6 Quality Assurance Requirements

A. Quality Assurance Plan

The design, procurement, installation, testing, and operation of the EDS equipment, unless stated otherwise below, were performed in accordance with the WVNS equipment specifications and industry standards such as NEMA, UL, NEC and manufacturer's quality assurance plan requirements. In addition, applicable requirements of the ASME NQA-1 Standard were applied.

B. Quality Conformance (QC)

Quality Conformance to specifications were performed by the contractor for the VF system. The QA program of the contractor was reviewed and approved by the WVNS QA Department. WVNS personnel performed testing, inspection, surveillance, and/or audit at the contractor's facilities.

1.2.7 Inspection and Test Requirements (Equipment)

Specifications for equipment procurement and installation included requirements for inspection and/or tests necessary to demonstrate that the EDS equipment will perform satisfactorily. Tests performed on the EDS system equipment include:

A. Factory acceptance tests at the manufacturer's facility.

The test requirements are specified in the procurement equipment specification or construction specifications written for the VF EDS equipment.

B. Field testing by the contractor at the VF following installations.

The test requirements are specified in the construction specification written for the VF EDS equipment.

1.2.8 Start-up & Operation Test Requirements (Systems)

Installation and start-up procedures will include requirements for examinations and/or tests necessary to demonstrate that the EDS will perform satisfactorily. Tests performed include:

A. Operational tests of all control equipment functions (i.e., control selector switches, pushbuttons, indicating lamps, limit switches).

B. Operational tests of all protective equipment functions (i.e., breaker and overload heater settings).

C. Operational tests of all alarm functions (see Appendix-G).

D. UPS tests at site for full load operation and function in accordance with the WVNS approved vendor test procedures. Necessary adjustments, as required, shall be documented in the operating manual.

E. VF EDS capacity testing: The objective of this test is to verify the capability of the EDS to provide power to the VF systems during periods of peak vitrification demand.

F. SDG tests at site in accordance with the WVNS approved vendor test procedures. Necessary adjustments as required shall be documented in the operating procedures.

G. Test to simulate loss of off-site power and to start the SDG automatically, connecting it to 480V switchgear bus A1 & A2 and loading the 480V switchgear bus A1 & A2 according to the table in Appendix B.

1.2.9 Codes and Standards

Applicable nationally recognized codes, standards, and regulations of the following institutes, associations, standard boards, and WVNS document WVNS-DC-022, were used during the design, manufacturing, testing, and installation of the EDS equipment:

A. American National Standards Institute (ANSI)

B. National Electrical Manufacturers Association (NEMA)

C. National Fire Protection Association (NFPA) National Electric Code (NEC)

D. American Society of Mechanical Engineers NQA-1 Quality Assurance Program Requirements for Nuclear Facilities.

2.0 DESIGN DESCRIPTION

The EDS is designed to satisfy the requirements outlined in Section 1.0. This section provides a general system design overview of the detailed equipment design description provided in section 2.4. The VF EDS covered by this document is indicated on drawing 905-D-208.

2.1 System Design Description

The EDS shown on drawing 905-D-208 is designed to receive off-site utility power at 34.5 kV, step down the voltage, and provide auxiliary power at 480V and below to various VF systems located in the Vitrification, Cold Chemical and Fuel Oil Storage Building. The EDS consists of the following major subsystems:

A. 34.5 kV System
B. 480V System
C. 480V Standby Generation System
D. 240/120V & 208/120V System
E. 120V UPS System

2.1.1 34.5 kV System

The normal electrical power for the operation of the VF is supplied from the NMPC 34.5 kV Utility System. The NMPC system has two independent power sources supplying the switching station, one from a station located at North Angola, NY and the other from a station located at Machias, NY located at approximately 40 and 16 km, respectively, from the site. A power failure from one source does not interrupt service to the VF.

2.1.2 480V System

The main 480V system distribution is indicated in the one-line diagram drawing 905-D-207. The diagram shows that during normal operation, the power is received from two 2000/2300/2240/2576 kVA, OA/FA, 55°C/65°C, 34.5 kV-480/277V step-down transformers. Each transformer supplies a low-voltage switchgear A or B. The switchgear A & B with its associated transformers A & B make up a double-ended, low-voltage substation. Switchgear sections A and B are electrically connected via a normally open, low-voltage, 3200A rated power circuit tie breaker. Switchgear A distributes power to various 480V MCCs, 480V switchgear A1 & A2, and power panels (PPs). The MCCs, switchgear A1 & A2 and PPs supply power to various loads throughout the VF system at 480V and lower voltage levels.

2.1.3 480V Standby Generation System

The 480V Standby Generation System (on-site) consists of a VF diesel generator rated at 600 kW, three-phase, four-wire, 480/277V located in the secondary filter room area and a STS/PVS diesel generator rated similar to VF SDG is located in the PVS building. The 480V standby power supply to the VF Building is indicated in the one-line diagram drawing 905-D-200 and 905-D-208.

2.1.4 240/120V & 208/120V System

Various capacity 480-240/120V and 480-208/120V step-down transformers for 240/120V and 208/120V power and lighting panels are provided to distribute power to various single-phase loads throughout the VF at the 120V level.

2.1.5 120V UPS System

One seismically qualified Uninterruptible Power Supply (UPS) system, 67-UPS-1, rated 10 kVA, 120 VAC and its associated power panel, is provided to distribute power and control to various 120V single-phase vital AC loads such as the 480V switchgear A1 & A2 (for tripping and closing AC power circuit breakers), HVAC control panel 67-V019 (including programmable logic controllers or PLCs), diesel generator battery charger, CCTV control cabinet located in the Crane Maintenance Room (CMR) operating aisle, and the vertical shield door No.2 controls. This UPS is located in the VF HVAC Control Room (secondary filter room area).

Two non-seismic UPSs, 63-UPS-2 and 63-UPS-3 (each rated 20kVA, 120V AC) and their associated power panels are provided to distribute single-phase power and control to various 120V AC vital loads. UPS 63-UPS-2 provides AC power to equipment located in the VF Control Room, (for example, the operator distributed control system (DCS), shift engineer/supervisor DCS station, CCTV control cabinet, communication system, HVAC control panel 67-V020, and the control room radiation monitor rack). This UPS also supplies alternate power to HVAC control panel 67-V-019 located in the HVAC Control Room at the secondary filter room area. UPS 63-UPS-3 provides AC power to equipment located in the VF Control Room, (for example, the fire protection control panel, DCS Controllers (MICON) No. 1, 2, & 4, operator station and the VF instrument racks).

2.2 System Performance

2.2.1 Normal Operating Mode

Under normal operation of the VF system, the EDS receives power at 34.5 kV from the NMPC off-site utility power system, steps the voltage down and supplies AC auxiliary power to various VF systems at 480V and lower voltage levels.

2.2.2 Standby Operating Mode

On loss of off-site utility power, the VF will receive power from the VF Standby Diesel Generator (SDG), as well as from the Permanent Ventilation System (PVS) diesel generator. Upon detection of undervoltage at the 480V switchgear A1 and A2 buses, a signal is given to start the VF (engine-driven) SDG. This SDG can supply sufficient power to selected loads to enable shutdown of the VF systems and sustain power to the loads in the event of a temporary or extended power outage. The PVS building SDG supplies lighting power and alternate power to the SFCM in order to prevent glass from solidifying.

2.2.3 Fault Mode Operation

In the event of a failure due to a single short circuit of either the 34.5-0.480 kV power transformers A or B, or a single short circuit in the 480V switchgear A or B, or opening of the main circuit breaker feeding switchgear A or B, will result in partial operation of the VF. During normal operations of the EDS, a short circuit fault on any

outgoing feeder from the 480V substation A to the 480V MCCs and 480V switchgear A1 and A2 will most likely trip the entire 480V MCC loads or 480V switchgear A1 and A2 bus loads from service.

2.3 System Arrangement

The EDS equipment and components are located at the load center areas throughout the VF for close proximity to the equipment and to minimize feeder cable lengths.

2.3.1 480V System Arrangement

A. The 480V Substations A & B are electrically connected via a normally open, low-voltage, 3200A rated power circuit tie breaker. This arrangement is shown on one-line diagram Dwg. 905-D-207. This 480V Substation A & B is located east of the Vitrification Building.

B. Various 480V MCCs and 480V switchgear A1 and A2 supply power to various loads at 480V levels. The location of the equipment is shown on dwgs. 905-D-030, -032, and -042.

2.3.2 240/120V and 208/120V System Arrangement

The 240/120V system consists of a 480/240V transformer and 240/120V power panel. The 208/120V system consists of various capacity 480-208/120V transformers and 208/120V power and lighting panels that are installed throughout the VF. The location of these power and lighting panels are shown on Dwg.905-D-030, -032, and -042.

2.3.3 120V UPS System Arrangement

The seismically qualified 120V UPS (67-UPS-1) is located in the VF HVAC Control Room (secondary filter room area) at elevation 111.50 feet.

The non-seismic 120V UPSs, 63-UPS-2, and 63-UPS-3 are located in the northwest area of the VF building at elevation 100.00 feet.

2.4 Equipment Design Description

This Section describes the EDS major equipment by components.

2.4.1 480V Substation A and B.

The 480V Substation A & B consists of incoming line sections, transformers, and metal enclosed switchgear assemblies consisting of air magnetic power circuit breakers, current and potential transformers with associated protective relaying and metering. All the electrical equipment was supplied by Siemens-Allis. The configuration of 480V Substation A and B is shown on One-Line Diagram Drawing 905-D-207. (This is part of System 30.)

The major components of 34.5-0.480kV Transformers A and B are given in Appendix H. (This is part of system 30.)

The metal enclosed switchgear assembly consists of five sections, each with major components tabulated in Appendix I. (This is part of System 30.)

The major components of 480V, three-phase, three-wire Switchgear A1 and A2 are tabulated in Appendix J.

2.4.2 480V Standby Power Generation System

The 750kVA, 600kW standby diesel generator (SDG) features a fuel oil daytank, local control panel, and starting batteries. It is located inside the Diesel Generator room at elevation 100.00 feet. The main diesel fuel storage tank is located northeast of the VF building. The associated 480V Switchgear A1 and A2 are located at elevation 100.00 feet and 110.50 feet, respectively.

The power configuration of the SDG is indicated on One-Line Diagram Drawing 905-D-200. The SDG system's major component descriptions, weights, and dimensions are tabulated in Appendix K.

2.4.3 480V Motor Control Centers

The VF 480V, 3 ph, 3-wire, Motor Control Centers (MCCs) are fed from the 480V Substation A, and provide the means of distributing low voltage power and motor control throughout the VF facility.

The power configuration for each MCC assembly is shown on one-line diagrams dwg. 905-D-201, -203, -204, and -205.

The 480V MCCs are Westinghouse (W) type 2100 line MCC with NMA AB-1 molded case circuit breakers (MCCB,s) W Series C rated 150A frame at 480V, 100KA current limiter, and NEMA rated LV motor controllers.

The 480V, 3-phase, horizontal buses are 600A or 800A rated, and the vertical buses are all rated 600A. The horizontal and vertical buses are braced for 42 kA or 50 kA rms symmetrical with ground bus and include the following major components:

Main Incoming Breaker: 800A or 600A, 3-pole, nonautomatic molded case circuit breaker or air circuit breaker.

Motor Feed: Full-voltage reversing or non-reversing combination circuit breaker starters as required for application consisting of NEMA-AB1 thermal magnetic three-pole circuit breaker and NEMA size rated motor controller.

2.4.4 480/240/208/120V Power Panels & 208/120V Lighting Panels

The 480/240/208/120V Power Panels (PPs) and 208/120V Lighting Panels (LPs) are fed from 480V Switchgears A1 and A2 and 480V MCCs provide the means of distributing miscellaneous low-voltage power and lighting throughout the VF.

Power configurations of the PPs and LPs are shown on one-line diagrams 905-D-208.

2.4.5 120V UPS System

A. One 10kVA Uninterruptible Power Supply (UPS), 67-UPS-1, is seismically qualified and supplied by CYBEREX INC. The UPS consists of the following major rated components:

System Input -
- Normal Source Input - 480VAC, 20A, 3ph, 60Hz
  Alternate Source Input - 480VAC, 21A, 1ph, 60Hz

Rectifier/Charger -
- 105-140V dc, 85A

System Output -
- 120VAC, 104A, 0.8 to 1.0 pf, 1 ph 60Hz

Static Switch -
- Continuous Current Rating 125%
  (% of inverter full load)

Maintenance Bypass Switch -
- The maintenance bypass switch allows make-before-break transfer from the output of the UPS and the alternate source.

- Rated 600V,200A

UPS Model - #4T-10/1BF1M-S
- The 67-UPS-1 receives alternate DC power from a dedicated 125V DC battery system, which is part of the UPS system.

- Two parallel strings of PRC 12100X, each string having ten batteries rated 12V nominal, can supply 120V, 10KVA AC load for 60 minutes.

B. Two 20 kVA, identical Uninterruptible Power Supplies (UPS), 63-UPS-2 and 63-UPS-3, are manufactured by CYBEREX INC. and consist of the following major rated components:

System Input -
- Normal Source Input 480V, 41A, 3ph, 60Hz
- Alternate Source Input - 480V, 42A, 1ph, 60HZ

Rectifier/Charger System Input -
- 105 140Vdc, 180A
- 120V, AC, 208A, 0.8 to 1.0 pf, 1ph, 60Hz

Static Switch -

- Continuous Current Rating 125%
  (% of inverter full load)

Maintenance Bypass Switch -

- The maintenance bypass switch allows make-before-break transfer from the output of the UPS and the alternate source.

- Rated 600V, 200A

UPS Model No. 4T-20/1BF1M -

- The 63-UPS-2 and 63-UPS-3, receive alternate DC power from a dedicated 125 DC storage battery system, which is part of the UPS system.

- Three parallel strings of PRC 12100X, each having ten batteries, rated 12V nominal, can supply 120V, 20 KVA AC load for 60 minutes.

2.4.6 Motors

Normally supplied with the mechanical equipment and are part of each system.

2.4.7 Cables

Power and control cables for the 480V system are 600V rated, stranded copper conductor, THHN or XHHW insulation, suitable for continuous operation at a conductor temperature not to exceed 90°C. All power and control cables penetrating the Vitrification Cell and for underground applications in wet or dry locations are 600V rated, stranded copper conductor, XHHW insulation suitable for continuous operation at a conductor temperature not to exceed 75°C in wet locations and 90°C otherwise. The power conductors are sized to carry the maximum available short circuit current for the time required for the circuit breaker to fuse to clear a fault.

Additional information on power, control, and special cables are provided in the procurement equipment specification or construction specification and dwg. 905-B-210.

2.4.8 Grounding

The grounding complies with the requirement of NFPA70. A separate ground conductor has been used. The raceway systems have not been used as ground paths. The 480V, 208/120V and 240/120V systems are solidly grounded.

The 120V UPS has been provided with a DC ground fault alarm and indicator.

The ground fault on VF exhaust fans (67-K001A and 67-K001B) are detected and alarmed by a sensitive relay which is connected to a current transformer whose core surrounds the three conductors of the circuit.

Additional information on grounding is provided in the purchase or construction specification and dwg. 905-D-219.

2.5 Instrumentation and Control

2.5.1 General

The control and instrumentation of the EDS is provided locally and/or remotely. Each 480V switchgear A1 and A2 has an instrument compartment consisting of a voltmeter and voltmeter selector switch for monitoring voltage of the incoming feeder to the switchgear A1 and A2 bus. The outgoing switchgear breakers have indicating lights to indicate open or close position of the breaker, an ammeter with a selector switch for monitoring outgoing feeder current, and test pushbuttons for testing operation of the switchgear feeder circuit breakers. The SDG has a local panel consisting of a voltmeter, ammeter, voltmeter/ammeter phase selector switch with an off positon, rheostat for voltage adjustment, frequency meter, local selector switch for local or remote control of the SDG, indicating lights for various diesel alarms and status conditions at the local panel, remote control desk (CP 67-V019), and in the Distributed Control System (DCS). The UPSs has alarms and status conditions and a common alarm to DCS and CP 67-V019 (for 67 UPS-1 only). The combination starter units in the 480V MCC's are provided with selector switches, pushbuttons for manual and remote controls, and indicating lights for indicating the status of operation.

The DCS located in the VF Control Room is the center for monitoring and alarm annunciation. Most of the controls and the monitoring are located at the 480V Substation A and B, 480V switchgear A1 and A2, 480V MCCs, UPSs, and Control Panels 67-V-019, -020, and 021. All lamps, control switches and meters are located in the indicated switchgear and MCCs.

2.5.2 Hardwired Interlocks

Hardwired interlocks, when required, are indicated on the control wiring diagrams of the EDS.

3.0 OPERATIONS

The operation procedures provides operational information during normal operation and under abnormal conditions such as loss of off-site power.

3.1 Normal Operations

During normal operation, all off-site power is delivered to the EDS from the 480V Substation A and B switchgears. The power from these switchgears are further distributed to 480V switchgears A1 and A2, 480V MCCs, and 480V, 240/120, 208/120V power panels from which low-voltage motors and other loads derive power.

3.2 Standby Power Operations

Upon loss of off-site power the 600kW VF SDG and the 600kW STS/PVS SDG are the two sources of standby power to feed EDS selected loads located at the VF building.

3.2.1 The VF SDG in the secondary filter room area is designed to withstand the effects of the site Design Basis Tornado or the Design Basis Earthquake without loss of power to components essential to assure shutdown of the VF. The VF SDG is designed for starting and automatic acceptance of the largest single load (either exhaust fan 67-K-001A or fan 67-K-001B) in order to maintain proper cell negative pressure. When required, other loads can be administratively loaded to the VF SDG. The selected loads are shown in Appendix B.

The VF SDG controls are designed for automatic as well as manual starting. The manual starting is performed at the HVAC control panel 67-V-019 (remote) and the VF SDG local control panel. The choice of the operating location is accomplished with RUN/STOP/REMOTE selector switch located

at the VF SDG local control panel. Placing the selector switch in the RUN mode permits manual starting of the diesel generator from the local control panel only. The position of the selector switch is also indicated on the HVAC control panel 67-V-019. Placing the selector switch in the remote mode permits manual starting of the diesel generator from the HVAC control panel 67-V-019 only. The normal position of the selector switch shall always be the remote position so that the VF SDG will start automatically on loss of off-site power.

3.2.2 Automatic Loading and Tripping of SDG

A. The 480V switchgear A1 and A2 buses have been provided with undervoltage relays to detect low voltage condition on these buses. If a sustained, degraded voltage condition or loss of voltage on either of these buses is sensed by its time-delayed undervoltage relays, the main circuit breaker opens, and the loads connected to the bus are de-energized. The VF SDG is started automatically on these loss of voltage.

B. The undervoltage relays (with inverse time characteristics) 27-1, 27-2 for each buses are physically located in each 480V switchgear A1 and A2. The relay contacts are combined in a two out of two logic to generate a loss of voltage signal (LOVS) and one out of three logic combining relay contacts of 74-1, 74-2, and 27X relays to generate an alarm on loss of instrument potential transformer fuse. A complete los of off-site power would result in LOVS actuation. The VF SDG would start and be available to accept loads within 10 seconds.

C. Starting Mechanism and System

The VF SDG is started by 24VDC battery current. The battery is mounted near the unit.

D. Tripping of Diesel Generator Breaker

Manual tripping of the VF SDG breaker can be done by the operator from the control panel CP-V019. Tripping of the VF SDG breaker will occur in the event of:

1. Closing of the 480V switchgear A1 and A2, main circuit breaker,

2. Overcurrent

3. 480V switchgear A1 and A2 bus fault.

E. Interlocks

Automatic connection of exhaust fan 67-K-001A and 67-K-001B to the associated 480V switchgear A1 and A2 bus is prevented by a bus voltage sensing relay contact present in the closing circuits of the individual breakers.

F. Permissives

1. To start the VF SDG automatically, the following conditions are to be satisfied:

   a. Local selector switch in remote position and control fuses intact

   b. Diesel generator reset relay in reset position.

   c. There is a tripping of both of 480V Switchgear A1 and A2 main circuit breakers.

2. The VF SDG is tripped during the following engine conditions:

   a. Engine overspeed
   b. Over crank
   c. Low lube oil pressure
   d. High coolant temperature

3. To close the VF SDG circuit breaker:

   a. Manual, to dead bus after diesel generator start

      1) 480V switchgear A1 & A2 main circuit breakers are open.

   b. Auto Close to dead bus after diesel generator start

      1) generator reset relay must be in reset position

      2) generator voltage and frequency must be 480V and 60Hz respectively

3) 480V Switchgear A1 & A2 main circuit breaker are open.

C. Load De-energization

Loads connected to the 480V switchgear A1 and A2 are de-energized upon loss of normal (off-site) source power. The VF SDG breaker closes to the dead bus with time delay (maximum 30 seconds), to be set finally during start-up. The VF SDG will energize 480V switchgear A1 and A2 buses. The STS/PVS diesel generator will energize MCC-A, which in turn will supply power to power panel PP-3 located in the Vitrification Building. When the VF SDG and STS/PVS SDG are the only source of supply, all loads except for the exhaust fan 67-K-001A or 67-K001B, UPS 67-UPS-1 and lighting panel that are normally connected to the 480V switchgear A1 and A2 and power panel PP-3 are not re-energized. Subsequent reconnection of loads to the diesel source can be done manually under administrative control (Appendix B).

During operation of the VF and STS/PVS SDGs, all engine conditions such as pressure, temperature and speed are monitored at the DG Control Panel located on the DG skid. The generator parameters such as voltage and current are monitored at the HVAC Control Panel 67-V019 for the VF SDG and at the Redco panel located in the electrical room of the PVS building for the STS/PVS SDG. Abnormal condition for the VF SDG will be alarmed in the HVAC Control Panel 67-V-019 and also at the DCS located in the VF Control room. The operation of the STS/PVS SDG is monitored hourly as per the applicable standard operating procedure (SOP) from the PVS building locally. Both the diesel generators have sufficient capacity to supply power to all associated loads to enable shutdown of the facilities in the event of a short or extended power outage.

3.3 Return to Normal Operations From Standby Operations:

Upon return of normal AC power, it will be required to take the VF SDG off the EDS and restore normal AC power to the EDS. The following steps are necessary in developing the procedures for the VF SDG:

3.3.1 Use Appendix B to determine what loads are going to be affected for this operation and take action accordingly. For example, it may be necessary to determine which exhaust fan 67-K001A or B need to be run.

3.3.2 Once step 3.3.1 is established, trip the DG breakers on both the 480V switchgear A1 & A2 from CP-67V019. This will remove the voltage from 480V switchgear A1 & A2 bus and it will be a dead bus. All the loads supplied from these buses will have no power.

3.3.3 The diesel generator will be running on no load and may be allowed to run so, for a short duration, in accordance with the manufacturer's recommendation and procedures.

3.3.4 Close the main circuit breaker to the 480V switchgear A1 & A2 from CP-67-V019. This will restore normal AC power to the 480V switchgear A1 & A2. Use step 3.3.1 to load the 480V switchgear bus A1 & A2.

3.3.5 There will be no power available for a short duration (maximum 30 seconds) due to this transfer from standby mode to return to normal AC supply mode.

4.0 SYSTEM SETPOINTS, LIMITATIONS, AND PRECAUTIONS

4.1 Set Points

4.1.1 FEEDER BREAKER - All feeder breakers are rated as a minimum 125% of the motor full load ampere (FLA).

4.1.2 FEEDER BREAKER SETTING - The breaker rating and its tripsetting are indicated in the corresponding distribution drawing for the 480V Substation A and B, 480V switchgear A1 and A2, MCCs,power panel and lighting panels. The short time (ST) trip is set at 8 times the long time (LT) setting for the air circuit breaker at 480V Substation A. The air circuit breaker at the 480V switchgear A1 & A2 supplying power to the exhaust fan 67-K-001A and 67-K-001B,the instantaneous (I) trip is set at 10 times the LT setting. Final setting will be established during the relay coordination study. The magnetic trip setting for the MCCB's are set not to exceed 11 times motor FLA.

4.1.3 OVERLOAD HEATER - All the overload relay heaters are ambient temperature compensated. The heaters are selected on the basis of the actual FLA and service factor as shown on the motor name plate.

Additionally, the following guidelines shall be followed:

A. When motor and overload relay are in the same ambient temperature condition and the service factor of the motor is 1.15 to 1.25, select heater from the Heater Application Table shown in drawing 905-D-205. If the service factor of the motor is 1.0, or there is no service factor shown, or a maximum of 115% protection is desired, select one size smaller heater than indicated.

4.1.4 CABLE - All cables feeding the motor and other loads are rated at 125% minimum of the FLC.

4.2 Limitations

4.2.1 Normal Power Supply - The limitations to the normal electrical power supply for the operation of the VF system is dictated by the following factors:

A. There is a simultaneous failure of the two NMPC independent power sources (off-site utility system), supplying the switching station.

B. The 34.5-0.48kV Power Transformers A and B capacity; each transformer is rated to accept a maximum of 2576kVA load at forced air cooling and a maximum temperature rise up to 65°C.

C. The tripping of either or both of the 480V Substation A and B main circuit breakers.

The loss of the 34.5kV feeder supplying the 480V Substation A ,the loss of the 34.5-0.48kV Power Transformer A, or the tripping of the 480V Substation A main circuit breaker will require connection of switchgear A to switchgear B through the bus tie breaker. Substation B can provide only a limited power. Continuation of VF operations will most likely be placed into a limited mode with these auxiliary power limitations.

4.2.2 Power and Lighting Panels - All transformers supplying the Power and Lighting Panels can be loaded up to 100% of their name plate rating unless otherwise stated in the panel circuit schedule drawing. Normally all the power panels/lighting panels shall be loaded up to 80% of their incoming breaker rating but can be loaded to 100% until alternate power source is provided. Under these circumstances the kVA rating of the transformer shall not be exceeded.

4.2.3 Standby Power Supply

Upon loss of the normal off-site power from the utility, standby power to EDS is supplied by the VF SDG, which can supply maximum power of 600kw at 0.85 power factor to selected loads. Also the on-site 600kW STS/PVS SDG has enough capacity to supply lighting power to the VF building and warm up power to the SFCM to prevent glass from solidifying.

4.2.4 Uninterruptible Power Supply (UPSs)

The UPSs are designed to supply 125% of its rated capacity continuously for two hours.

4.3 Precaution

The design and installation of equipment meet all applicable codes and standards in effect at time of manufacture and/or installation. Maintenance procedures for the EDS equipment, which contain safety and precaution requirements as recommended by the vendor, that must be adhered to during preventive maintenance and surveillance activities of the equipment and its components.

5.0 CASUALTY EVENTS AND RECOVERY PROCEDURES

The EDS Failure Modes and Effects Analysis (Appendix L) and VF SDG Failure Modes and Effects Analysis (Appendix M) shall be used as guidelines in developing casualty events and recovery procedures.

6.0 MAINTENANCE

6.1 All the major equipment of the EDS is described in section 2.4 and covered by preventive maintenance procedures. Preventive maintenance (PM) for the electrical equipment or components are accomplished by the issuance of a computerized PM Job card scheduled for each job assignment from the Work Control Center (WCC). Each electrical equipment has an identification number which is displayed on the maintenance card and maintenance frequency schedule.

Upon completion of a job assignment, a maintenance card will be completed by the assigned engineer or designee and sent back to the WCC for updating and recording a computerized maintenance record for each equipment item. Most of the electrical equipment except for the SDG System, battery and UPS systems are maintained every one to three years. However, certain equipment for the SDG System, battery/UPS systems, and other systems are subjected to a weekly or monthly maintenance surveillance.

The preventive maintenance of the EDS equipment is vital to ensure maximum availability of the EDS for VF operation. Maintenance procedures of the EDS (to be listed) are the basic guidelines used for the maintenance work to meet the objectives of DOE Orders and the WVNS Maintenance Management Plan. Adequate preventive maintenance enhances configuration control of the design basis conditions by the implementation of the maintenance procedures specific to each equipment and/or component.

6.2 The following guidelines shall be followed in developing the VF maintenance procedures:

A. The Industry standards and vendor recommendations.

B. Shop test and Field test data shall be used as a baseline data for evaluation of future measurements performed during routine maintenance, for example, insulation resistance (megger testing on the electrical equipment).

C. Lock and Tag Procedure (SOP 00-4).

D. Existing Standard operating procedures, SOP 00-11, SOP 00-19, SOP 00-23, SOP 00-28, and SOP 30-08.

E. Requirement of Industrial Work Permit (IWP).

F. Requirement of Radiation Work Permit (RWP) assure radiological safety.

G. Precautions and limitations for all circuits shall be analyzed for inadvertent start of equipment when lifting leads or using jumpers.

H. Extreme caution shall be used when operating the breaker in the test position, because there may be an auxiliary contact to other equipment, which may cause an inadvertent trip or start of the equipment.

I. Alarm Response (Appendix G)

APPENDIX A

REFERENCE DRAWING LIST

	DRAWING NUMBER	DESCRIPTION
1.	900D-4200	Primary Power - One line diagram
2.	905D-207	480V Substation A and B
3.	905D-208	VF - One line diagram
4.	905D-200	480V Switchgear A1 & A2 one line diagram
5.	905D-030	GA-VF, Plan at Elevation 100 ft.
6.	905D-032	GA-VF, Plan at Elevation 110 ft.
7.	905D-034	GA-VF, Plan at Elevation 124 ft.
8.	905D-042	GA-CC, Plan at Elevation 115 ft and above.
9.	905B-210	Cable and conduit list
10.	905B-219	Grounding Notes and Details

APPENDIX B STANDBY POWER LOADS			
EQUIPMENT	SOURCE (480V SWITCHGEAR)	LOAD (kVA)	POWER (kw)[1]
Exhaust Fan (67-K-001A)[2]	A1	150	120
UPS, 67-UPS-1	A1	10	8
AHU Fan, 67-V003A[2]	A1	5	4
Crane Op. Aisle Htr. (67-V028)	A1	12.5	10
Off-Gas Htr. (63E-032)	A1	62.5	50
Process Crane Control Station	A1	30	24
CMR Roof Hoist	A1	30	24
Diesel Fuel Storage PP-14	A1	70	56
Exhaust Fan (67-K001B)[2]	A2	---	---
Lighting Panel, LP-6	A2	15	15
Power Panel, PP-5	A2	30	24
Off-gas Htr. (63E-037)[2]	A2	---	---
CMR Crane Control Station	A2	2	1.6
Cell Shield Door No. 2	A2	92	73.6
Shield Door No. 1	A2	1	0.8
Unit Heater (67-V029)	A2	3.75	3
AHU Fan 67-V003B[2]	A2	---	---
TOTAL[4]		513.75	414

NOTES:

1) Values based on as assumed power factor of 0.8.
2) Only one unit is running at a time. Thus load of redundant component is not shown.
3) Except for the exhaust fan (67-K001A or 67-K001B), UPS 67 UPS-1 and LP-6, all other loads need supervision for restarting the units.
4) The diesel generator is rated, 3-phase, 4-wire, 480/277 AC, 600 kw, continuous rating (750 KVA @ 0.8 p.f.)

APPENDIX C UPS 67-UPS-1 POWER LOADS	
EQUIPMENT	LOAD (VA)
HVAC Control Panel (67-V019)	740
480V Switchgear, A1	400
480V Switchgear, A2	400
Pump VP-510	600
Shield Door No. 2	1,450
Distribution Cabinet (63-CCTV-05)	1,200
Stack Rad Monitor Control Panel	500
TOTAL[1]	5,290

NOTE:

1) The UPS (67-UPS-1) is rated single-phase, two-wire, 120V, 10 kVA for one hour on complete loss of on-site and off-site power.

APPENDIX D UPS 63-UPS-2 POWER LOADS	
EQUIPMENT	LOAD (VA)
Operator Station No. 1, DCS/CCTV	1,310
Operator Station No. 1, Desk/ILDS	360
VAX Terminal and Dot Printer	660
Shift Engineer Station DCS/CCTV	1,215
Shift Engineer Desk/ILDS	360
CMS-1	1,440
CMS-1 Leg No. 2	600
CMS-1 Leg No. 4	360
Control Panel 67-V020	475
Control Panel 67-V/020	300
Distribution Cabinet 63-CCTV-12	1,200
Glass Pour Viewing System Cabinet	600
Control Room Rad. Monitoring Desk	600
CCTV Supervisor Desk, Distribution Cabinet	1,200
Shift Supervisor Station	814
CMS-1 Leg No. 1	780
CMS-1 Leg No. 3	540
Chiller Lead/Lag Control Cabinet	500
DS-67-V019 (Alternate Power to 67-V019)	740
CMS-1 Leg No. 5	---
TOTAL[1]	14,054

NOTE:

1) The UPS (63-UPS-2) is rated single-phase, two-wire, 120V, 10 kVA for one hour on complete loss of on-site and off-site power.

APPENDIX E UPS 63-UPS-3 POWER LOADS	
EQUIPMENT	LOAD (VA)
Melter Viewing System (MVS) Camera	12
Instrument Rack (I.R.), 2W2, 2W3	10
I.R., 2N6, 3E8, 2E9, 2E10	40
Instrument Cabinet IC-1	122
I.R., 3W8, 3W7, 3W1, 3W6, 2W5, 3W5	120
Operator Station No. 2, DCS/CCTV	1,215
Operator Station No. 2, Desk, ILDS	360
ILDS Control Room Rack	720
I.R., 2N7, 2W4, 3E9, 3E10, 3W2, 3W3, 3W4, 66-IR-01, C/P 63-V041C, C/P 63-V041D	95
DCS Panel No. 1	1,681
DCS Panel No. 4	120
DCS Panel No. 2	1,099
I.R., 2N8, C/P 65-CP-02	35
MVS & VAX Interface Cabinet	1,200
Fire Control Panel (VFFCP)	1,200
TOTAL[1]	8,029

NOTE:

1) The UPS (63-UPS-3) is rated single-phase, two-wire, 120V, 10 kVA for one hour on complete loss of on-site and off-site power.

APPENDIX F - VF SYSTEM INTERFACES				
SYSTEM NUMBER	DESCRIPTION	TYPE OF POWER SUPPLY	POWER SUPPLY INTERFACE POINT (Note 1)	CONTROL WIRING DRAWING (CWD) SHEET NOS. (Note 2)
30	Electrical distribution	480V Power to PP3	480V MCCA Bkr.4M (located in PVS Bldg.)	
30	Electrical distribution	480V Power	480V Sub-station A	
42	Telecommunication	120V Power	PP-10	726, 730, 731
63F	Cell Walls & Ex-Cell Arrangement (also including lighting & CCTV)	120V Power	PP3, 6 and 10, LP1,2,3 3A, 6,7,8	330, 331, 332, 333
63H	Off-Gas & Vessel Vent	480V Power	480V Swgr. A1 & A2	58, 75, 77, 109, 111-115, 117, 118, 120, 121, 123, 126-130, 132-136, 138, 140, 141, 143, 144, 147, 148, 150, 151, 722
63I	Primary Process (includes Rad Monitoring System)	480V Power and 120V Power	480V MCC#2 PP-3, 4, 5, 10, 11	10, 11, 14-20, 22, 25, 29-36, 38, 42-47, 50, 52, 60-63, 66-72, 78, 79, 81, 83-86, 90, 94-96, 98-108, 501-594, 601-606, 650, 661-673, 701-706, 713, 715, 724, 725
63J	Canister Decontamination	120V Power	PP-11	158-161, 164, 166
63K	In-Cell Remote Handling Maintenance and Viewing	480V and 120V Power	480V Swgr A2 PP-6	206, 220-224, 349-358, 361, 367, 698, 699, 714, 717, 905C-307 (all sheets)
63L	Canister Welding	480V and 120V Power	480V MCC#2 PP-3, 4, 12	716, 718-720
63AR	VF Argon gas	120V Power	PP1	720
63CC	VF Chilled Water	480V Power	480V MCC #1, 2, 3	309-318, 321-323, 326-329

APPENDIX F - VF SYSTEM INTERFACES				
SYSTEM NUMBER	DESCRIPTION	TYPE OF POWER SUPPLY	POWER SUPPLY INTERFACE POINT (Note 1)	CONTROL WIRING DRAWING (CWD) SHEET NOS. (Note 2)
63FO	Diesel Engine Fuel Oil & Exhaust	480V and 120V Power	480V Swgr. A1, PP-14	461, 693, 712
63FP	Fire Detection & Protection	120V Power	PP5, 11	415
63IA	VF Instrument Air	---	---	217
63SC	VF Steam and Condensate	120V Power	PP-5	193
63UA	VF Utility Air	---	---	217
63WW	VF Drains	120V Power	LP-6	152-154, 205, 727
65	VF Cold Chemical	480V and 120V Power	CC MCC, PP-11	905-B-303 (all sheets), 6-10, 57, 630
66	VF Closed Loop Cooling Water	480V and 120V Power	480V MCC#1 PP-11	192, 608, 632-634
67	VF HVAC	480V Power	CC MCC, 480V MCC #1, 2, 3 480V Swgr A1 & A2	169, 170, 239-269, 271-273, 276-286, 288-309, 334-348, 360, 450-452, 454, 470, 651-666, 723
69A	VF Sampling	120V Power	LP-1, PP-5, 11, 14, LP-8	635, 636-696, 700, 728
69B	VF Sample Transfer	480V Power	480V MCC#1	210, 211, 215
200A	VF Instrumentation	120V Power	Various Instrument Racks, Control Panels, devices	2, 5, 370-379, 381-386, 607, 629, 631, 707-711, 729

NOTE 1: The reference drawing number for CC MCC, 480V MCC 1, 2, 3, 480V switchgear A1 and A2, various PPs and LPs are indicated on drawing No. 905-D-208.

NOTE 2: All CWD sheet numbers refer to control wiring diagram drawing number 905-B-305, unless otherwise noted.

APPENDIX G

ALARM RESPONSE
(SDG, Day Tank, 480V Switchgear A1& A2, and UPS)

S NO.	ALARM NO.	ALARM MESSAGE	LOCATION OF ALARM	RESPONSE
1	67-LAL-705	Fuel oil leak D.G. Room	CP 67-V019 (Note 1)	Note 4
2	67-LALL-706	low/low level fuel oil daytank	CP 67-V019	Note 4
3	67-LAH-706	hi level fuel oil daytank	CP 67-V019	Note 4
4	67-LAL-706	low level fuel oil daytank	CP 67-V019	Note 4
5	67-IAH-751	480V Swgr. A1 Bus Main Bkr. (2B) tripped	CP 67-V019	Note 4
6	67-IAH-752	480V Swgr. A2 Bus Main Bkr. (2B) tripped	CP 67-V019	Note 4
7	67-IAH-753	480V swgr. A1 Bus SDG Bkr. (2C) tripped	CP 67-V019	Note 4
8	67-IAH-754	480V Swgr. A2 Bus SDG Bkr. (2C) tripped	CP 67-V019	Note 4
9	67-EAL-755	480V Swgr. A1 Bus control power not available	CP 67-V019	Note 4
10	67-EAL-756	480V Swgr. A2 Bus control power not available	CP 67-V019	Note 4
11	67-UA-759	480V Swgr. A1 Bus under voltage/control fuse blown	CP 67-V019	Note 4
12	67-UA-756	480V Swgr. A2 Bus under voltage/control fuse blown	CP 67-V019	Note 4
13	67-UA-757	VF, SDG pre alarm	CP 67-V019	Note 5
14	67-UA-758	VF, SDG tripped	CP 67-V019	Note 5
15	67-UA-761	67-UPS-1, common alarm	CP 67-V019	Note 3
16	67-UA-762	VF, SDG ground fault	CP 67-V019	Note 4
17	63-UA-2501	63-UPS-2, common alarm	DCS station (Note 2)	Note 3
18	63-UA-2502	63-UPS-3, common alarm	DCS station	Note 3

NOTES:

1) Control Panel 67-V019 (CP 67-V019) is located at elevation 110.00 feet, in the HVAC Control Room, Secondary Filter Room Area. All the alarms on CP 67-V019 are also transmitted to DCS.

2) The Distributed Control System (DCS) is located at elevation 114.59 feet in the VF Control Room.

3) Determine the exact cause of the alarm immediately from the alarm panel located in the affected UPS and correct the condition.

4) Respond to the alarm immediately and correct the condition.

5) Determine the exact cause of the alarm immediately from SDG local control panel and correct the condition.

APPENDIX H		
34.5 - 0.480 kV TRANSFORMERS A & B		
ID No.	Component Description	
A & B	Power Transformer	Siemens-Allis
	Rating	Power:2000/2300kVA OA/FA @55° C & 2240/2576kVA OA/FA @65° C
	Voltage	34.5kv-480/277V, three-phase 60Hz with four 2.5% High-voltage (HV) side taps (two above & two below nominal)
	Connection	Delta HV side and solidly grounded Wye low voltage (LV) side. Aluminimum Windings
	Impedance	6.2% on 2000kVA base
	Coolant	Silicone. Capacity 504 US gallons (A), 547 US gallons (B)
	Serial Nos.	70402-1(A), 0599401001(B)
	Mfg. Date	1984(A), 1986(B), Made in Canada
	Weight (lbs)	Core & Coils 7975(A), 7445(B)
		Coolant 4085(A), 3975(B)
		Tank & Access. 5100(A), 4330(B)
	Total Weight	17160(A), 15750(B) (lbs)

APPENDIX I 480V SUBSTATION A & B (Switchgear Assembly)		
Section (Compartment No.)	ANSI Function Number	Component Description
		Main and Bus Tie Breaker:
1(B), 3(B), 5(B)	52	3200A, 3 pole, air circuit breaker, Siemens RL3200, 65KA symmetrical interrupting capacity, with 3200:5A Current Transformers (3 No.) for Main Breaker (1B, 5B)
	50/51	Three-phase, Inverse Time Overcurrent and Instantaneous Relay
		Feeder Circuit Breakers:
1(C), 2(B)	52	1600A, 3-pole aircircuit breaker, Siemens RL1600, 50kA symmetrical interrupting capacity, with 1600:5A Current Transformer (1 No.)
	50/51	Three phase Inverse Time Overcurrent and Instantaneous Relay
2(A,C,D) 4 (A,B,C,D)	52	800A, 3-pole, air circuit breaker, Siemens RL800, 42 KA symmetrical interrupting capacity, with 800:5A Current Transformer (1 No.)
	50/51	Three-phase, Inverse Time Overcurrent and Instantaneous Relay

APPENDIX J 480V SWITCHGEAR A1 & A2	
Switchgear (Compartment No.)	Component Description
A1 & A2 (2A)	Instrument compartment with voltmeter and voltmeter selector switch, relays
A1 & A2 (2B, 2C, 2D)	800A, 3-pole, air circuit breaker, Westinghouse ACB DS800, 30KA symmetrical interrupting capacity with 600:5A (2B, 2C), 300:5A (2D), Current Transformer (1 No.)
A1 & A2 (1)	Power Distribution Panel with Molded Case Circuit Breaker (MCCB), rated 150A, Westinghouse type FB series.

APPENDIX K 600kW STANDBY DIESEL GENERATOR	
Component	Component Descrriptior
Diesel Engine	Cummins Model: VTA28-G2 Design: V-12, 4-cycle Aspiration: turbo-charged and aftercooled Bore*stroke: 5.5in *6.0 in Displacement: 1710 cubic inch Piston speed: 1800 fpm @1800 rpm Compression ratio: 14.1 to 1 Cyclic irregularity: 1/124 Power: 900 bhp (671kw) at 1800 rpm Fuel Consumption: 45 gals per hour @ Full Load Gen Output
Lubrication System	Lube oil sump capacity: 89 qt. Lube oil consumption: <53qts/100hrs
Engine Jacket Water Heaters	Two (2) Jacket Water Heaters, each:
	4.0 kW, 480V, 3-phase, Onan #333-0144. Thermostat contact (Adj. 80° to 106° F)
Cooling System	Coolant capacity, set mounted radiator: 176 qt.
Fuel Oil System (System 63FO)	One 200-gallon day tank Tramont Series TRS-200 (200 gal total), with Tramont System 2000 electrical control module (ECM), along with critical high-level emergency shutdown (Tramont #3250), mounted near to DG skid base. The main 7,000-gallon diesel fuel storage tank is installed within 100 feet N-W of VF building. Fuel Oil Transfer Pump rated 20GPM with 60 feet suction lift and 2 hp, 460V, 3ph, TEFC motor.

APPENDIX K 600kW STANDBY DIESEL GENERATOR	
Component	Component Descrription
Generator & Exciter	Onan Model 600.0 DFY-4XR, 750 kVA, 600 kW, 0.80 pf, 480/277V, 902A, 1800 rpm, single-bearing, forged flange shaft for direct coupling to diesel engine and with foot-mounted stator. NEMA MG-1 Std. design Class F insulation. Brushless exciter directly coupled to generator shaft. Per unit Reactance: Synchronous reactance-1.69 Direct axis transient-0.16 Direct axis sub transient-0.12 Dimensions & Weights: Dimensions (ins): L-136, W-42, H-89 (ins) Gross weight: 12,000 lb.
Generator Instrument Transformers	Two 480-120V Potential Transformers (PT,s), primary open delta connected to Generator Line Terminals (located in 480V Switchgear, A1 & A2, cub. 2C) One 600:5A Current Transformer (CT) mounted on the line side of generator for metering (located in 480V Switchgear A1 & A2, cub. 2C) Three current transformers mounted on the line side of generator for use with Automatic Voltage Regulator (AVR) & metering in the SDG local control panel. Current sensor with ground-break, ground-fault relay and monitor panel in the SDG local control panel.
Battery System	24 Vdc Battery System, Onan Part No. 416-0439, 225 AH Willard Battery Co. Part No. P439, 24 Vdc, 6a output (20 cell) Battery Charger (120V 1-ph input), Onan #305-0346

APPENDIX K 600kW STANDBY DIESEL GENERATOR	
Component	Component Descrription
SDG Local Control Panel	Diesel Engine Control: Engine control relays to start, control, protect and annunciate the diesel engine functions.
	Gage Panel, Meters, & Control Switches: Oil temperature gauge AC ammeter (dual range indicates current each phase) Voltmeter, high/low meter scale indicator Voltmeter/Ammeter phase selector with an off position. Frequency meter (pointer type) Console mounted rheostat for +/- 5% voltage adjustment Lamp test switch Running Time meter (RTM) Tachometer (TACH) Control Selector Switch (CS) GFI system
	Indication & Alarms: The following indication & alarms are included: Run (GREEN Light) Overcrank Shutdown (RED) Overspeed Shutdown (RED) High coolant temperature shutdown (RED) Low oil pressure shutdown (RED) Pre-warning for high coolant temperature (YELLOW) Pre-warning for low oil pressure (YELLOW) Low coolant temperature (YELLOW Light - indicates inoperative coolant heater) Switch off (Flashing RED - indicates genset not in automatic start mode) Low fuel (YELLOW) GFI alarm SDG emergency shutdown

APPENDIX K 600kW STANDBY DIESEL GENERATOR	
Component	Component Descrription
SDG Local Control Panel	Generator & Governor Controls: Automatic Voltage Regulator (AVR). Onan-Torqe Match II with voltage adjusting rheostat. Electronic governer (speed adjustment on control module)

APPENDIX L

ELECTRICAL POWER DISTRIBUTION FAILURE MODES AND EFFECTS ANALYSIS

COMPONENT	FUNCTION	FAILURE MODE	FAILURE DETECTION AND EFFECT/CORRECTIVE ACTION
NMPC 34.5-kV Utility System	Normal power to Vitrification Facility	Breaker failure, feeder short circuit (one power source or both power sources)	a. In the event of a failure of one power source in the utility system, the normal power will still be maintained through the second power source in the utility system. b. In the event of failure of both the power sources in the utility system, there will be shut down of Vitrification process due to non-availability of off-site power. c. The Vitrification diesel generator will enable shutdown of the facilities in the event of extended power outage. d. Ensure alternate power for the SFCM in the VF building is arranged through the PVS building diesel generator to prevent glass from solidifying in the SFCM.
34.5-kV/480V Transformers (Either transformer A or B)	Provide 480V power to substation A & B	Internal short circuit	Associated circuit breaker to the bus opens. No power supplied to 480V bus by affected transformer. Reduced power supplied through the unaffected transformer and the tie breaker. Remove faulted transformer, repair and reinstall. Shut down of Vitrification process.
480V Switchgear Bus A or B Main circuit breaker	Connects Transformer A or B to the switchgear Bus A or B respectively	Failure to close, or overheating, (poor contact)	No power supplied to bus through the affected breaker. Reduced power supplied through unaffected transformer and tie breaker. Remove, repair, and re-install main circuit breaker. Shut down of Vitrification process.
480V Switchgear Bus A, Feeder Circuit Breaker	Connects switchgear Bus A, to MCCs and 480V switchgear A1 and A2.	Failure to close or overheating (poor contact)	No power supplied to affected load. Loss of power to affected auxiliary system component(s). Shut down of Vitrification process may be necessary. Remove, repair, and re-install feeder breaker.
480V Motor Control Centers (MCCs)	Starts and stops motors for various auxiliary system equipment; provide motor running protection	Contact will not close or trips off	No power to affected auxiliary system motor(s). Shut down of Vitrification process may be necessary. Locate problem and repair.
480V Switchgear A1 and A2	Supplies power to exhaust fan (67-K001A and 67-K001B), UPS, various control stations, power panels, lighting panel, and heaters.	Breaker trips off	No power to affected system(s). Shut down of Vitrification process may be necessary. Locate problem and repair as soon as possible.
Diesel Generator Feeder Circuit Breaker	Connects diesel generator to 480V switchgear A1 and A2 bus during loss of off-site power.	Failure to close, or overheating, (poor contact)	a In the event of failure of one breaker (either Bus A1 or A2), there will be reduced power available to the available bus (see Appendix B for standby power requirements). b. In the event of failure of both the breakers (i.e., Bus A1 and A2), there will be no power available to auxiliary loads during loss of off-site power. Shut down of Vitrification process may be necessary. Repair as soon as possible.

APPENDIX L

ELECTRICAL POWER DISTRIBUTION FAILURE MODES AND EFFECTS ANALYSIS

COMPONENT	FUNCTION	FAILURE MODE	FAILURE DETECTION AND EFFECT/CORRECTIVE ACTION
UPS (67-UPS-1)	Supplies essential AC control power to equipment in the Secondary Filter Room area.	Rectifier Inverter failure. Battery failure.	1. Alarm in the HVAC control panel 67-V-019 and in the DCS. No interruption in the power supply. Power is maintained through the bypass power supply. 2. In the event of failure of both the off-site and on-site power, the UPS can supply power for 1 hour to all the loads per Appendix C, provided there is no failure to the batteries at the same time.
UPS (63-UPS-2 and 63-UPS-3)	Supplies essential AC control power to instrument paks and equipment in the Vitrification building control room.	Rectifier Inverter failure. Battery failure.	1. Alarm in the DCS cabinet in the Vitrification building control room. No interruption in the power supply. Power is maintained through the bypass power supply. 2. In the event of failure of both the off-site and on-site power, the UPSs can supply power for one (1) hour to all the loads per Appendix D & E provided there is no failure to the batteries at the same time.
Distribution Cabling	Connects breakers to various load centers and loads.	Short circuit	Failure trips the affected breaker. No power to affected load center or load. Locate fault and repair.

APPENDIX M			
DIESEL GENERATOR FAILURE MODES AND EFFECTS ANALYSIS			
COMPONENT	FUNCTION	FAILURE MODE	FAILURE DETECTION AND EFFECT/CORRECTIVE ACTION
Diesel Generator Support Systems (Fuel Oil, Lube Oil, Cooling Water, and Starting Systems)	To start the diesel engine and maintain the engine temperature lubrication and fuel oil at optimum levels	Failure to carry out required function	Detected by affected support system parameter monitors. Diesel engine fails to start or is shut down automatically. See Note below.
Diesel Generator Breaker	Connects diesel generator with 480V switchgear A1 and A2 buses	Failure to close, or overheating (poor contact)	Locate fault and repair. See Note below.
480V Cable Intertie	Connects diesel generator breaker with 480V switchgear A1 and A2 buses	Short circuit	Failure trips generator breaker, diesel generator cannot supply power. Locate fault and repair. See Note below.

NOTE:
In the event that the Vitrification Facility normal electrical power distribution fails and the diesel generator fails to deliver power, the facility goes into shutdown status. Essential monitoring systems are on uninterruptible power (UPS), giving status information, and enabling recovery of systems.