Entergy Vermont Yankee

Root Cause Analysis Report

CR-VTY-2004-2015

Electrical Fault / Fire

Contents of Report

ROOT CAUSE ANALYSIS REPORT

CR Number: VTY-2004-02015 **Category:** ☒ A ☐ B

Assigned Department: Technical Support

Investigation Team:

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Mitch McCluskie	Operations	
Dan Jeffries	Engineering	
Doug Amidon	Engineering	
Alex Wonderlick	Engineering	
Brian Copperthite	Security	
Stan Howe	Training	
Fred Burger	Technical Support	Mentor
Jim Taylor	Technical Support	Mentor
Terry Herrmann	Corrective Action (JAF)	
James Stead	Engineering (JAF)	
John Bonner	Engineering (WPO)	
Rich Hansen	Hansen Engineering	Consultant- Fire Forensics
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Tim Autrey	Technical Support	Management Oversight

Date Report Completed: July 16, 2004

☒ **The CR was caused by or identified an equipment/component failure.**
(If YES, complete VYAPF 0009.06 (Equipment Failure Evaluation Checklist) in accordance with Appendix M.)

☐ **The CR involved one or more HU inappropriate acts.**
(If YES, complete VYAPF 0009.05 (ENVY Human Performance Evaluation Form) in accordance with Appendix H.)

Problem Statement:

An electrical fault caused a plant trip and fire on June 18, 2004.

Executive Summary:

NOTE

1. The results of the Root Cause Analysis contained in this initial report are based upon information derived to date from plant data analysis, interviews of personnel, and evaluation of plant components and equipment following the event. Additional testing and analysis will be performed. Any additional insights or conclusions gained from this testing will be included in a revised / amended version of this report.

At 06:40 am on June 18, 2004, Vermont Yankee Nuclear Power Station experienced a severe electrical fault that caused a generator trip and plant scram. The electrical fault resulted in arcing in the low voltage bushing box on the top of the Main Transformer. During or shortly following the electrical fault, oil leaking from a flange in the vicinity of the bushing box ignited, resulting in a fire. A Notification of Unusual Event was declared at 06:50 am.

The plant fire brigade was dispatched at 06:41 am and used water spray from a nearby hydrant to quench the fire. Local fire departments began arriving at 07:05 am. The fire was extinguished at 07:17 am. The Notification of Unusual Event was terminated at 12:45 pm.

The electrical fault and fire resulted in severe damage to the low voltage bushing box on top of the Main Transformer, to the Generator PT Cabinet in the Turbine Building, and to the isophase bus duct itself. No significant damage occurred to the Main Transformer, to the Unit Auxiliary Transformer, nor to the Main Generator. There were no personnel injuries as a result of this event.

After the fire was extinguished, the Vermont Yankee plant staff was organized into a number of teams to evaluate the plant post-trip response, assess the damage from the electrical fault and fire, perform a Root Cause Analysis, and to repair the damage. The Outage Organization was implemented. A Recovery Manager was named to perform damage assessment and initiate repair/replacement activities. The Damage Assessment Team and the Root Cause Team worked closely together to identify, collect and assess relevant information that allowed the Root Cause Analysis to be performed.

Based upon the analysis of this event to date, it appears that:

? Small arc strikes along the "B" isophase bus and duct (along the vertical and horizontal sections external to the Turbine Building) indicate the presence of loose material within the "B" isophase bus duct at the time the arc strikes occurred.

- One of the flexible connectors associated with the "B" isophase bus had a detached laminate layer. The detached laminate layer was discovered in the lower elbow of the "B" isophase bus duct external to the Turbine Building.
- The "A" Surge Arrester failed, resulting in a path to ground on the "A" isophase bus.
- The combination of arcing between the "B" isophase bus and bus duct and the failure of the "A" Surge Arrester resulted in a phase-to-phase electrical fault (short circuit through ground) between the "A" and "B" phases of the 22kV bus.
- Subsequent to the "A" and "B" phase electrical fault, an additional fault occurred between the "C" low voltage bushing and the bushing box on top of the Main Transformer causing damage to the "C" isophase bus.
- During or shortly following the electrical faults, oil leaking from a flange in the vicinity of the "C" low voltage bushing on top of the Main Transformer ignited, resulting in the fire.
- Damage from this event was limited to major portions of the isophase bus and the low voltage Main Transformer bushings. There was no damage to the Main Transformer or to the Main Generator.
- Preventive Maintenance requirements for the isophase bus and the surge arresters were not adequate.

Report Narrative:

NOTES

1. The conclusions contained in this initial Root Cause Analysis report are based upon information derived to date from plant data analysis, interviews of personnel, and evaluation of plant components and equipment following the event. Additional testing and analysis will be performed. Any additional insights or conclusions gained from this testing will be included in a revised / amended version of this report.

2. The narrative portion of this report is written to highlight key information and insights gained from numerous detailed analyses. The attachments associated with this report contain many of the details needed to more fully understand the issues involved.

Affected Equipment Overview (see Figure 1)

The Vermont Yankee Main Generator output voltage is nominally 22,000 volts (22kV). The Main Generator is connected in three phases ("A", "B", and "C") to the station Main Transformer via the isophase bus duct system. Within the isophase bus duct system, each phase is routed through a separate enclosed duct. Each of these ducts provides cooling air flow around the associated current carrying bus. A cooling system is provided to cool the air, and bus duct cooling fans provide for air circulation within the ducts.

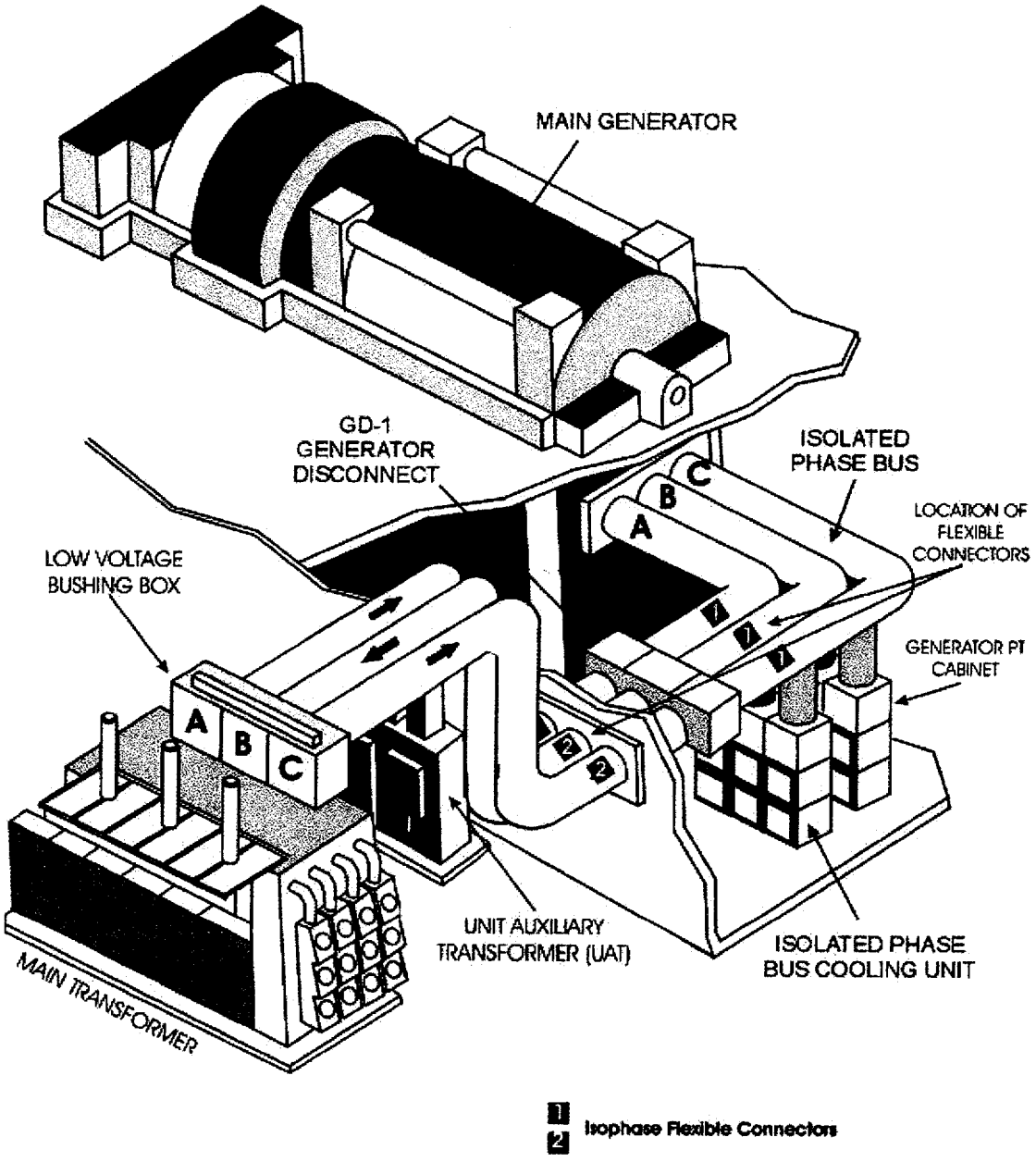
The isophase bus duct fans route the air supply through the "B" phase (center) bus duct to the "B" section of the low voltage bushing box at the top of the Main Transformer. The air then traverses through openings into the "A" and "C" sections of the low voltage bushing box and returns via the "A" and "C" bus ducts to complete the cycle. The majority of cooling airflow is recirculated in this fashion, with necessary makeup coming from inlet dampers inside the Turbine Building.

The Main Generator connects to the 22 kV isophase busses via flexible braided copper links. The isophase busses themselves are provided with flexible connectors that allow for expansion and contraction as changes in system current flow (due to startup, shutdown, and other load changes) result in heatup and cooldown of the busses. These flexible connectors consist of a stack of aluminum laminate layers welded together on the ends. Flexible connectors are provided in two locations along each isophase bus. One set is located within the Turbine Building between the isophase cooling unit and the Generator Disconnect Switch (GD-1) (indicated as "1" in Figure 1). The other set (indicated as "2" in Figure 1) is located external to the Turbine Building, just upstream of the vertical section of the isophase bus duct.

Each of the isophase busses connects via a flexible link to the associated Main Transformer winding via a bushing located within its associated section of the low voltage bushing box on the top of the Main Transformer. The Main Transformer receives the 22 kV input from the Main Generator and steps up the voltage to 345 kV for distribution to the electrical grid. The bushings that connect the isophase busses to the Main Transformer are referred to as the "low voltage" bushings due to their 22 kV connection (vice the "high voltage" bushings which connect the 345 kV side of the Main Transformer to the electrical grid).

Prior to the Main Transformer, the isophase bus phases also connect to the Unit Auxiliary Transformer (UAT) via flexible links and associated bushings. The UAT is used to provide power to the various 4 kV busses within the plant during power operation.

Internal to the Turbine Building, each phase of the isophase bus is provided with a Potential Transformer (PT), used to measure voltage, as well as a capacitor and a surge arrester to provide protection against voltage surges. These components are housed in side-by-side compartments (one compartment for each phase). The three compartments are collectively referred to as the "Generator PT Cabinet".



General Isolated Phase Bus Layout

Figure 1

Event Precursors

Prior to this event, industry Operating Experience (OE) identified three separate instances where failures of either electrical bus flexible connectors or flexible links similar to those at Vermont Yankee have occurred. Additionally, an incident at the Shearon Harris Plant revealed that aluminum debris (foreign/loose material) in an isophase bus duct was an initiator of ground faults. Finally, three previous incidents within the industry have involved the failure of surge arresters. It appears that all three of these factors (failure of a flexible connector, debris / loose material in the bus duct, and a failed surge arrester) might have played a role in the Vermont Yankee electrical fault.

Approximately 24 hours prior to the ground fault event, the "GEN GND CURRENT HI" annunciator (7-A-2) alarmed. This annunciator is activated when the potential between the generator neutral bus and ground exceeds a pre-determined value, indicating a ground on the 22 kV bus. The alarm cleared after approximately one minute. CR-VTY-2004-1989 was written to document the alarm.

Plant Operations staff responded to the alarm in accordance with the Alarm Response Procedure. Plant management initiated actions to analyze and address the issue (in concert with fleet peers), and established temporary contingency expectations should the annunciator alarm a second time. This annunciator did not alarm again prior to the fault. Details of actions taken in response to this alarm are contained in Attachment 14.

Description of the Event

At 06:40 am on 06/18/2004, a two-phase electrical fault-to-ground occurred on the 22 kV System. The "B" phase faulted to ground in the low voltage bushing box on top of the Main Transformer (see Postulated "B" Phase Grounding Scenario in the next section), and the "A" phase faulted to ground in the surge arrester cubicle of the Generator PT Cabinet through the "A" phase surge arrester.

Within less than one cycle (11 milliseconds) of the electrical faults, the Main Generator protective relaying sensed the condition and isolated the generator from the grid within the following 5 cycles (83 milliseconds). A turbine-generator trip and reactor SCRAM followed. The plant response to the turbine-generator trip and reactor SCRAM was as expected, except that both Recirc Pumps tripped and other AC voltage anomalies were experienced as a result of the voltage transient associated with the faults. The plant response is detailed in the Post Trip Review (Attachment 2).

Approximately 400 milliseconds following the initial "B" and "A" phase faults to ground, arcing and ionization in the "B" section of the low voltage bushing box on top of the Main Transformer carried over to the "C" section of the low voltage bushing box. An oil leak developed at a flange in an oil pipe on top of the Main Transformer near the "C" section of the low voltage bushing box. The arcing or the heat from the fault ignited the oil, resulting in the fire.

The plant fire brigade was dispatched at 06:41 am. Due to a fire onsite lasting greater than 10 minutes, a Notification of Unusual Event (NOUE) was declared at 06:50 am. The fire brigade initiated fire hose spray from a nearby hydrant and quenched the fire, significantly diminishing the flame. Local fire departments began arriving at approximately 07:05 am. The fire was extinguished at 07:17 am.

The Notification of Unusual Event was exited at 12:45 pm.

The electrical ground faults and the fire caused considerable damage to the Generator PT Cabinet, the 22 kV isophase bus, and to the low voltage bushing box on top of the Main Transformer. Damage analysis and associated testing have indicated no damage to the Main Transformer, to the Unit Auxiliary Transformer, or to the Main Generator.

The response to the fire is provided in Attachment 8. There is no evidence that sabotage or other intentional act was involved in this event.

Postulated Grounding Scenario

The initial ground fault associated with this event occurred on the "B" isophase bus. Based upon the piece of laminate found in the elbow of the "B" isophase bus duct (at the bottom of the vertical section of bus duct external to the Turbine Building) and the arc strikes found on the "B" isophase bus (see Figure 2), the following sequence of events is postulated as the initiator of the ground faults:

? The laminate layer of the flexible connector suffered failure due to low cycle fatigue on the leading (upstream) edge of the laminate. With the isophase bus cooling system in operation, the laminate was lifted and protruded upward into the air stream.

? Caught by the air stream, the trailing edge of the laminate failed, and the laminate became detached from the flexible connector. The air stream within the duct caused the detached laminate to tumble downstream until it reached the vertical section of bus external to the Turbine Building. It is fairly clear that this occurred during the period the isophase bus was not energized during the most recent refueling outage (RFO24), as evidenced by a lack of arc strikes on the horizontal section of "B" bus internal to the Turbine Building.

? Sometime after bus energization following RFO24, a piece (or pieces) of the failed laminate and/or other material, now located in or at the bottom of the vertical section of the "B" isophase bus duct, was (were) moved by the air stream upward and outward toward the "B" low voltage bushing. Numerous arc strikes occurred en route (see Figure 2), each arc strike representing a momentary ground of the "B" phase bus.

? At some point during this travel of the piece(s) of laminate, arcing to ground occurred in the area of the "B" low voltage bushing, resulting in increased ionization within the "B" section of the low voltage bushing box. The arcing caused the "B" phase-to-ground voltage to decrease to zero and the "A" and "C" phase-to-ground voltage to increase from 12.4 kV to 21.5 kV. During one of these arcing events, the "A" surge arrester failed, resulting in a fault (short circuit) through ground between the "A" and "B" phases.

? Following the fault through ground between the "A" and "B" phases, arcing and ionization in the "B" section of the low voltage bushing box carried over to the "C" section of the low voltage bushing box, resulting in a fault to ground at this location.

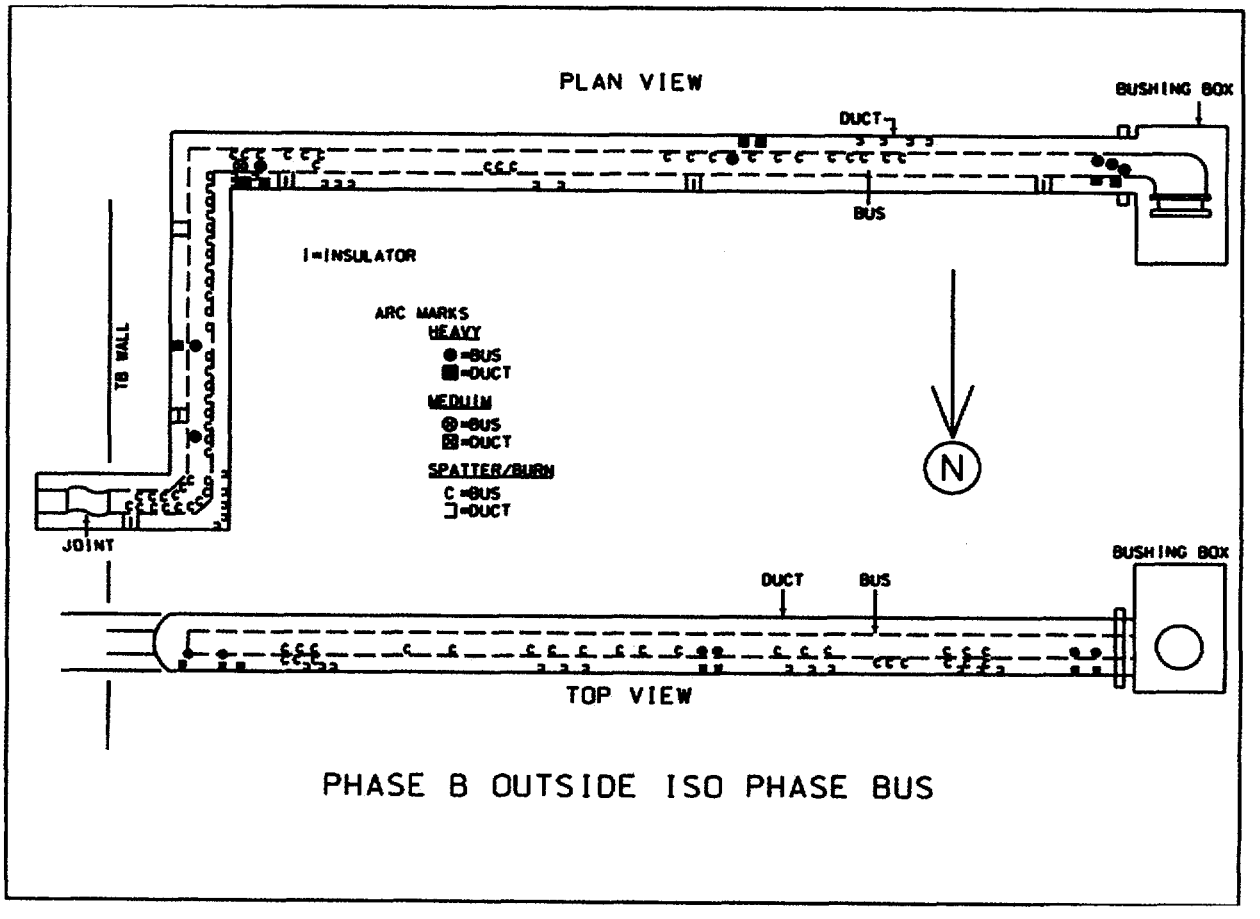


Figure 2

Results of Barrier / Fault Tree Analysis

Barrier Analysis

A Barrier Analysis was utilized to evaluate the Organizational and Programmatic aspects involved with this event. In this process, both administrative and physical barriers were considered. The Barrier Analysis Table is included as Attachment 17 to this report. Based upon the analysis, barriers that apparently failed or factors that appear to have contributed to this event included:

- ? Inadequate use of Operating Experience
- ? Inadequate inspection and testing of the isophase bus and associated components, specifically the flexible connectors and the surge arresters
- ? Inadequate quality control in the manufacturing process, resulting in inadequate weld buildup on the failed flexible connector
- ? Poorly configured inspection ports in the isophase bus duct, making thorough inspection of the internal components extremely difficult
- ? An Alarm Response Procedure that allowed continued plant operation following a plant ground annunciator that alarmed and subsequently cleared
- ? Either design or material inadequacy (indeterminate at the present time) on the oil flange adjacent to the "C" compartment of the low voltage bushing box.

Fault Tree Analysis of the Fire

A Fault Tree analysis technique was used to analyze the event. The fault tree is contained as Attachment 12 to this report. An overview of the results follows.

The Fault Tree was used to identify discreet elements and potential causes of the fire. A fire requires three elements: oxygen, fuel, and a heat/ignition source. Each of these elements was analyzed to identify what was (and was not) present, and what could (and could not) have been contributing factors.

Oxygen was present due to air in the atmosphere and in the low voltage bushing box at the top of the Main Transformer. Additionally, the isophase bus duct cooling system, which continued to run through the majority of the event, provided forced air flow from the Turbine Building outward through the "B" isophase bus duct, with a design return path through the "A" and "C" isophase bus ducts. This air flow appears to have provided a positive air supply at the point of ignition, while the normal return air flow path tended to draw combustion products into the "A" and "C" isophase bus ducts.

Fuel was present due to a leaking flange on an oil pipe on top of the Main Transformer. No leakage was observed at this flange prior to the event; however, following the event leakage was observed from this flange, the dielectric washers associated with the flange bolts were either melted or mushroomed, the flange bolts were loose, and the transformer conservator (oil surge tank) was empty. Post event evaluation revealed the flange gasket

was burned at the location of the leak. The leaking flange resulted in the presence of oil in the vicinity of the "C" section of the low voltage bushing box.

Numerous scenarios were considered relative to the cause of the fire ignition source. Arcing was observed in the vicinity of the "B" and "C" low voltage bushings as the bushing box degraded during the event. This arcing apparently provided the heat necessary for ignition. Discreet evidence of arcing included eyewitness accounts as the bushing box degraded, a hole in the "B" section of the low voltage bushing box, evidence of arcing and metal splatter on the "B" phase bus up to the low voltage bushing box, and post-event data analysis that showed that grounds had occurred on both "B" and "C" phases.

To summarize the results of the Fault Tree Analysis, it appears that electrical arcing in the vicinity of the "B" and "C" sections of the low voltage bushing box on top of the Main Transformer provided the ignition source for oil that was leaking from an oil flange that was located nearby. Airflow from the isophase bus duct cooling system apparently helped to fan the fire and to draw combustion products into the "A" and "C" isophase bus ducts. It is not clear what caused the oil piping flange in the vicinity of the "C" section of the low voltage bushing box to leak.

Significant Time Line

The following Significant Time Line is included to provide a chronology of the more significant elements of the event as they appear to have occurred. This information is based upon plant transient data provided by various instrumentation systems and plant records. One of these instrumentation sources is referred to as the "Beckwith Relay", the "timestamp" of which is included in parentheses on the Time Line. Other sources of information used to analyze the chronology of the event included the Plant Process Computer, the Emergency Response Facility Information System (ERFIS) Computer, and the Control Room Logbook.

A more detailed Event Time Line is provided as Attachment 1 to this report. Time zero (T=0) on both the Significant and detailed time lines, as well as for all chronologies associated with this report, is the time of the initial electrical fault, which occurred on June 18, 2004 at 06:40:38 am.

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	**Event Description**
6/18/04 06:40:38 T=0 (4028 msec)	A "B" phase-to-ground fault occurs on the 22kV System. Based on significant arc damage and eyewitness reports, this ground fault occurred at the Main Transformer low voltage bushing box "B" phase-to-ground voltage shifts from approx. 12.4kV towards 0 kV. "A" and "C" phase-to-ground voltages shift from approx. 12.4kV towards 21.5kV.
6/18/04 06:40:38 102 msec (4130 msec)	As the "A" phase-to-ground voltage increases from 12.4kV to 21.5kV, the "A" phase surge arrester begins to conduct, establishing the second phase-to-ground fault. This creates a fault (short circuit) from the "A" phase, through ground, to the "B" phase. The "A" surge arrester catastrophically fails.
6/18/04 06:40:38 113 msec (4141 msec)	The instantaneous element of the 87/GMT "B" phase relay actuates and trips the Main Generator Backup Lockout Relay.

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	Event Description
6/18/04 06:40:38 113-196 msec (4141-4224 msec)	Over this 5 cycle period, 22kV voltage decreases to less than 50% of nominal levels due to the "A"-phase-to-ground-to-"B"-phase fault. This event resulted in corresponding voltage reductions in the 4kV system.
6/18/04 06:40:38 196 msec (4224 msec)	The following breakers trip within a few milliseconds of each other to de-energize the 22kV system: ? Main Generator Field Breaker ? Unit Auxiliary Transformer Output Breaker 12 ? Unit Auxiliary Transformer Output Breaker 22 ? Main Generator Breaker 1T (isolates the Main Transformer from the grid-south) ? Main Generator Breaker 81-1T (isolates the Main Transformer from the grid-north)
6/18/04 06:40:38 197 msec (4225 msec)	Main Generator "C" phase current drops from nominal levels to approximately zero due to isolation of the generator from the 345kV and 4kV systems. The fault between the "A" and "B" phases continues.
6/18/04 06:40:38 247 msec (4275 msec)	The Main Generator Primary Lockout Relay trips due to actuation of the Main Transformer Fault Pressure Relay. The Primary and Backup Lockout Relays initiate. No additional equipment actuations occur.
6/18/04 06:40:38 301-304 msec (4329-4332 msec)	Both channels of the Reactor Protection System (RPS) trip to initiate a full reactor SCRAM.

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	Event Description
6/18/04 06:40:38 425 msec (4453 msec)	Bus 2 voltage lowers sufficiently to reach the Residual Bus Voltage Relay 27R/2 setpoint (1000 volts). A residual bus transfer initiates closure of 4kV Breaker 23 to re-energize Bus 2.
6/18/04 06:40:38 478 msec (4506 msec)	Bus 1 voltage lowers sufficiently to reach the Residual Bus Voltage Relay 27R/1 setpoint (1000 volts). A residual bus transfer initiates closure of 4kV Breaker 13 to re-energize Bus 1.
6/18/04 06:40:38 572 msec (4600 msec)	Arcing/ionization at the "B" phase of the Main Transformer low voltage bushing box carries over to the "C" phase and initiates a fault at this location.
6/18/04 06:40:45	The "A" and "B" Recirc Motor Generator (MG) 4kV supply breakers trip.
6/18/04 06:40:45	ERFIS Data indicates that Main Generator field and stator currents have decayed to zero approximately 6 to 7 seconds after field breaker opening.
6/18/04 06:41	Fire Brigade responding to the fire.
6/18/04 06:50	Notification of Unusual Event (NOUE) declared due to an unplanned on-site fire not extinguished within 10 minutes (Emergency Action Level U-4-a).
6/18/04 07:17	Declared the fire extinguished.
6/18/04 12:45	Notification of Unusual Event (NOUE) terminated.

Important interview results

A series of interviews were conducted and eyewitness statements were captured. Key information and insights obtained through these interviews are provided below. Although these statements are summarized, in most cases the interviewees' significant choice of words are retained.

Pre-fire

[Component Engineer responsible for plant HVAC systems commenting on the modified isophase bus duct cooling system.]

- The modified isophase bus duct cooling system installed in RFO24 increased total system flow.
- The system was originally balanced for approximately 50% flow to the transformer and 50% flow to the generator. The new system was balanced to direct 70% flow to the transformer and 30% to the generator based upon the amount of duct to be cooled.
- The loose material removed from the "B" isophase bus duct following the event is definitely not part of any damper system currently or previously contained in the system.
- During RFO24, the Component Engineer found foreign material (fan shipping bolts still installed) inside the fan enclosure during an inspection before the work was completed. The foreign material was removed prior to closeout of the enclosure.

[Maintenance Technicians that performed the cleaning and inspection of the isophase bus duct completed 04/24/04.]

- The inspection was completed while work on the isophase bus duct cooling modification was still in progress.
- There was a lot of metal dust and shavings on equipment cabinets and the floor.
- There was no evidence of any foreign material inside the duct that the Technicians could see. Specifically, there was no visible foreign material inside the "B" phase duct in the immediate area of the insulator in the horizontal section of duct outside the Turbine Building wall.
- There were no oil leaks on top of the transformer.

[Implementing Engineer for the isophase bus cooling modification completed 04/27/04.]

- Most of the work performed was work from the bottom of the duct or equipment boxes so that foreign material would fall out and not be contained in the duct. The exception to this was the work done adjacent to the Generator Disconnect Switch, which was done from the side due to space constraints.
- All the welding inside the duct was done with the MIG process, which does not require a separate weld wire supply. The weld wire is fed through the welding device and consumed in the welding process.

- ? Welding of replacement ductwork was done with the replacement patch being larger than the opening, (thus no welding was done inside the duct).
- ? Where possible, the work was done on removable panels, which were cleaned and re-installed after the work was performed.
- ? Work on the Generator Disconnect Switch required drilling inside the switch enclosure.
- ? Foreign material control was reviewed every day with shift personnel and monitored by supervisors and the implementing engineer.
- ? Documented foreign material close out inspection records exist for each major piece of duct.

Fire

[Security Personnel] (Individuals in the vicinity of the Main Transformer at the time of event initiation)

- ? Personnel heard a loud bang and a buzzing sound from the transformer.
- ? Observed (from the Stores loading dock) a large blue electric current (others say a white flame) burning through the outer casing of the upper southwest side of the low voltage bushing box. The fire appeared to be growing and intensifying inside the box. The box started to melt and the fire turned red in color.
- ? Observed (from in front of the transformer, west side) a glowing bluish white light and then a flame like a blowtorch from the south and west sides of the bushing box.
- ? The Gaitronics was not working at the start of the event.

[Chemistry Personnel]

- ? Personnel heard a loud bang and a buzzing sound from the transformer.
- ? Observed (from the parking lot outside of the Stores loading area) two jets of fire coming out horizontally from the top middle of the bushing box. In 15-20 seconds, the jets extinguished. The transformer bushing box burst into flame as the witness got to Gate 2.

[Engineering Manager]

- ? Observed (from the third floor PSB) the T-1 Disconnects open in the main switchyard.
- ? Bushing box glowed on front right side. The interior of the box became visible.
- ? The white flame turned into orange flame.

[Maintenance Personnel]

- ? The Gaitronics was not working at the start of the event.
- ? Dositec computers were not working at the Maintenance shop checkpoint.

Post Fire

[Delta-Unibus Personnel]

- These personnel were on-site to assist the Damage Assessment team.
- They positively identified a piece of material removed from the "B" Phase Duct as part of a laminated flexible connector and identified two locations on the bus from which the piece might have come.

[National Conductor Personnel]

- On Saturday 06/26/04, while inspecting the "B" Phase flexible connector removed from the isophase bus inside the Turbine Building (between the isophase bus duct cooling unit and the Generator Disconnect Switch), it was noted that the outermost flexible connector lamination was missing. There are 22 laminations per connector, with two flexible connectors per side of the Bus. While inspecting this connector, National Conductor personnel noted that the weld at one end of the missing lamination section was "different from the others." It was pointed out that this weld did not rise above the lamination bundle like the other welds.

[S. D. Myers, Inc. technician that worked on the oil line flange attached to the "C" phase low voltage bushing turret of the Main Transformer immediately after the fire]

- There was no evidence of physical impact on the oil line or flange.
- The "C" turret flange joint bolts were loose and the joint was dripping oil.
- The red dielectric gasket was in good condition.
- The condition of the bolting dielectric sleeve and washers was as follows:
  - On the west side of the flange, the washers were melted away.
  - On the east side of the flange, the washers were "mushroomed" out over the metal washers.

Insights from the Related Conditions / OE Search

Related Conditions / OE information has revealed the following key points:

- There have been three recent (October 2002 and February / March of 2004) occurrences in the industry where failures of bus flexible connectors (flex joints) of similar design to those in place at Vermont Yankee have occurred. In the first case (October 2002), cracks in flexible connectors of similar design were discovered during inspections. In the other two cases (both resulting in bus grounds), laminate layers were broken off / damaged. **A dislodged laminate layer from a flexible connector was discovered in the "B" isophase bus duct during the investigation following the VY electrical fault / fire.**

? An incident at Shearon Harris revealed the initiator of ground faults to be aluminum debris (loose/foreign material) in the isophase bus duct. **Numerous small arc strikes have been identified on the "B" isophase bus and bus duct (indicating the presence of loose material within the duct).**

? Three incidents involving failed surge arresters have occurred. In two of these cases, degradation of the surge arresters due to component aging was specifically identified. **The surge arresters involved with this event have been in service in excess of thirty years.**

Insights from the Equipment Failure Evaluation

Isophase Flexible Connectors

A detailed equipment failure evaluation was conducted on the flexible connectors associated with the isophase bus duct system. The detailed evaluation is included as Attachments 7 and 16 to this report.

It appears that the failure of the "B" phase flexible connector laminate likely occurred as follows:

At initial fabrication, the "B" phase laminate welds were ground flush or nearly flush with the top surface of the laminate leaving very little weld ligament to retain the laminate sheet.

Over approximately 32 years of thermal cycling of the bus and bus duct (start-ups, shutdowns, load changes, etc.), the flexible connectors experienced significant thermal movement. It is believed that due to this thermal cycling, the edge of one of the attachment welds closest to the generator on the "B" phase flexible connector laminate experienced low cycle fatigue crack initiation (as evidenced by the dull oxide coating on the fracture surface over approximately 90% to 100% of the weld length). The oxide coating indicates that this weld had cracked at some time in the past.

Once this low cycle fatigue crack on the end weld had propagated a sufficient distance along the weld to allow the laminate to be lifted into the cooling air flow, the laminate would have most likely begun a high cycle vibration due to air flow over the laminate sheet. This high cycle vibration would have then placed additional stresses on already undersized weld ligaments and continued crack propagation. As the crack continued to propagate along the length of the end weld, the sheet lifted and more surface area of the laminate was exposed to cooling air flow. At some point the force exerted by the air flow against/over the ever increasing exposed surface area of the laminate was great enough to fail the small weld on the side of the laminate allowing it to fully lift and exposing its full surface area to cooling air flow. This condition would eventually result in failure of the remaining weld and separation of the laminate from the flexible connector assembly.

The inspection ports that existed in the isophase duct prior to the event did not allow for thorough inspections of the flexible connectors. These inspection ports were designed and primarily used for inspection of the standoff insulators within the duct. Had thorough inspections of the flexible connectors been performed, the indications of low cycle fatigue in the flexible connector that failed would have been identified and the connector would have been replaced. Inspection ports in the newly installed isophase bus ducting (post event) will allow for periodic inspections of the flexible connectors.

The most probable cause of the flexible connector failure is that excessive grinding (reinforcement removal) was performed during original fabrication. In addition, a low cycle fatigue crack initiated at the generator end laminate attachment weld and propagated to a point that ultimately lead to failure and separation of the laminate from the component. The increased air flow within the bus duct following the refueling outage modifications may have accelerated the failure timetable for the laminate; however, the failure would have occurred at some time in the future at the original flow rates.

Laboratory metallurgical examination will confirm the failure mechanism of the flexible connector. Further evaluation of the failed laminate will determine which portions of the as-found laminate are missing.

Surge Arresters

The electrical design of the 22 kV System includes a surge arrester and capacitor assembly connected to each phase of the isophase bus to provide overvoltage protection. During the electrical fault, the "A" phase surge arrester appears to have failed, resulting in a fault (short circuit) to ground. The "A" phase surge arrester was destroyed during the event (see Attachment 6).

Industry experience has revealed that surge arresters are subject to degradation (and eventual failure) due to component aging. The arresters installed at Vermont Yankee had been in service for greater than 30 years; although the arresters are visually inspected periodically, testing of the surge arresters was not performed during that time.

It was also discovered that the capacitors associated with these surge arresters contain PCBs. All three compartments of the Generator PT Cabinet and their associated components have been removed and appropriately contained. Minor PCB contamination in the Turbine Building occurred due to damage to the capacitor by the failed surge arrester. All PCB contamination in the Turbine Building has been remediated.

Conclusions of the RCA evaluation

The electrical grounds that initiated the event were apparently caused by a combination of loose material / debris present in the "B" isophase bus duct and failure of the "A" surge arrester. The catastrophic failure of the "A" surge arrester caused significant damage to the Generator PT Cabinet. The "A" surge arrester (as well as the "B" and "C" surge arresters) was in excess of thirty years old.

Material found in the "B" isophase bus duct consisted of a displaced laminate from one of the flexible connectors within the "B" isophase bus. Missing portions of this laminate appear to have played a role in event initiation. No additional loose/foreign material has been positively identified in any of the isophase bus ducts.

The electrical grounds on both the "B" and "A" isophase busses resulted in a phase-to-phase short circuit (through ground) between the two busses. All relays and plant protective systems functioned as designed to trip the plant and isolate the Main Transformer from the electrical grid.

Ionization of material within the "B" section of the low voltage bushing box on top of the Main Transformer apparently spread to the "C" section of the low voltage bushing box. The majority of the "C" and portions of the "B" sections of the low voltage bushing box were destroyed during the event. Even though the Main Generator trip and lockout functions had actuated, arcing in the vicinity of the "B" and "C" phases of the low voltage bushing box continued for a few seconds, due to decay of current within the Main Generator field windings.

The fire itself was caused by oil leaking from a displaced flange in the vicinity of the "C" section of the low voltage bushing box. The heat from the arcing in the bushing box apparently ignited the oil. The transformer conservator (oil surge tank) on top of the Main Transformer provided the oil source.

Testing has revealed no damage to the Main Transformer, to the Main Generator, or to the Unit Auxiliary Transformer (UAT).

The majority of isophase bus duct components associated with this event have been replaced. Some components involved with this event will undergo additional testing and analysis in order to gather additional information about the event. Any pertinent information will be added as a revision / addendum to this Root Cause Analysis report.

There is no evidence that the modifications installed and tested during RFO24 were the cause of this event.

Cause(s) of the Condition

Root Cause(s)

RC-1 **[O.2.d.1] Inadequate preventive maintenance of isophase bus**

Although the isophase bus is subject to a preventive maintenance cleaning and Doble Testing each refueling outage, the cleaning and inspection is limited to the stand-off insulators. Additional inspections to evaluate the condition of the bus (including its flexible connectors) would have detected degraded flexible connectors or the presence of loose/foreign material with the potential to ground the bus. The need for inspection of the flexible connectors was identified as a result of recent operating experience (OE) immediately prior to RFO24. This OE was being included as recommended preventive maintenance for future outages; however, it was not included in the preventive maintenance inspection performed during RFO24.

RC-2 **[O.2.e.1] No preventive maintenance on surge arresters**

No preventive maintenance testing was performed on the surge arresters or capacitors located in the Generator PT Cabinet. Industry experience has revealed that surge arresters degrade over time due to a combination of age, service environment and service conditions. Periodic testing would have detected degradation and allowed replacement prior to failure.

Contributing Cause(s)

CC-1 **[N.2.e.2] Fabrication deficiency**

The failed flexible connector was visually examined to determine the condition of the failed laminate. It was determined that during manufacturing, post-weld grinding had reduced the amount of weld metal applied to the laminate. Further examination will be performed to assess the failure and confirm the visual examination.

CC-2 **[M.2.d.2] Inadequate failure modes and effects evaluation**

The design philosophy of a fifty-minute delay prior to automatic trip of the Main Generator due to a ground fault does not provide adequate protection against equipment damage.

CC-3 **[L.3.b.2] Previous industry operating experience not effectively used to prevent problems**

The station response to industry operating experience was inadequate relative to the following:

- ? Inadequate actions in response to recommendations contained in SOER 90-01 (Ground Faults on AC Electrical Distribution Systems)
- ? No response to recommendation to perform preventive maintenance inspection of the 22 kV flexible connectors contained in EPRI Isolated Phase Bus Maintenance Guide TR-112784 (1999)
- ? Inadequate actions in response to periodic inspection and testing recommendations contained in EPRI Isolated Phase Bus Maintenance Guide TR-112784 (1999)

CC-4 **[M.2.z.2] Other (Inadequate system inspection requirements as part of modification package)**

The modification package for the RFO24 isophase bus duct modification did not require adequate inspection of the isophase bus and bus duct.

Extent of Condition:

The other areas of the 22kV System that were not replaced during the forced outage and that are cooled by ventilation flow were inspected during the forced outage to ensure they are clean and free of foreign material. There are no other high voltage electrical busses cooled by forced flow ventilation systems that could experience similar failures.

The maintenance programs of the other high voltage electrical systems that contain surge arresters were reviewed to verify that surge arresters are subject to periodic preventive maintenance testing or replacement. The results of the evaluation are provided in Attachment 13.

A review was performed of the four areas where flexible links and flexible connectors are utilized in the 22 kV System. Flexible links are used on both ends of the system. They are used on the generator end to connect the Main Generator to the isophase bus, and on the transformer end to connect the isophase bus to the Main Transformer and to the Unit Auxiliary Transformer (UAT). Flexible connectors are used in two places within each phase of the isophase bus duct system to connect sections of the bus itself.

? The failure of the aluminum isophase laminated flexible connector has been discussed in detail as part of the Root Cause Analysis. All of the aluminum flexible connectors used to connect the sections of the isophase bus have been removed and replaced with a more robust design as part of the isophase bus replacement and repair activities.

? The flexible links connecting the isophase bus to the Main Generator are the braided style, which have been shown to be a more reliable design than the laminated connectors. These flexible links, which revealed no signs of damage during post-event inspection, have been cleaned by Electrical Maintenance and returned to service.

? The Unit Auxiliary Transformer (UAT) is connected to the isophase bus via two sets of laminated copper flexible links per phase. The first set of flexible links, located in the vertical section of isophase bus connection to the UAT, was replaced with braided links during the isophase bus repair.

  The second set of flexible links, which connect the downstream side of the isophase bus to the UAT high voltage bushings, was inspected and determined to be satisfactory for return to service. Specifically, the decision to return these flexible links to service was based upon:

  ? The inspection of the flexible links did not reveal any sign of tearing or other degradation.
  ? The UAT termination compartment (bushing box) is isolated from the isophase bus duct cooling air flow, and is therefore not subject to any flow induced vibration.

? The flexible links connecting the isophase bus to the low voltage bushings on top of the Main Transformer were the copper laminated style. These links were inspected as part of the Root Cause investigation. Two of the twelve "B" phase flexible links showed signs of tearing of the outer lamination. It could not be conclusively determined whether the tearing occurred before (or as a result of) movement of the isophase bus during the fault.

  - An inspection of the "A" phase flexible links showed no signs of tearing or separation of the laminates.

  - The "C" phase flexible links were not inspected for tearing or separation due to the extensive fault and fire damage.

  All of the flexible links connecting the isophase bus to the low voltage bushings on top of the Main Transformer have been replaced with braided flexible connectors as part of the isophase bus repair effort.

No other applications were identified where flexible links or flexible connectors are utilized to allow for thermal expansion of electrical components and the links or connectors are not part of a program for periodic visual or thermographic inspection.

Related Operating Experience:

Previous Related Conditions (ENVY):

A search of the PCRS database was conducted from 6/1/1995 to 6/28/2004 for the following words separately: surge, isophase, ground fault, arrester, 22 kV and foreign material.

From the approximately 350 Condition Reports reviewed, none was similar to the event currently being investigated. Some of the items were of interest because they involved foreign material and surge arresters.

Corrective actions from these events would not have prevented the electrical fault or fire.

Foreign Material

CR-VTY-2001-00829 involved a loose piece of metal that was found in the "B" phase isophase bus duct. This piece was determined to be a part of the old aluminum blade louvers. The old louvers had been replaced in 1973. This piece was discovered during cleaning and inspection activities.

Surge Arresters

CR-VTY-2002-01079 identified the failure of a lightning arrester on Startup Transformer T-3-1A during testing. As a result, the low side arresters on the Startup Transformers were replaced. The high side arresters were not. Maintenance personnel familiar with component testing were contacted to comment on the possibility that this event offered an opportunity to recognize the desirability of testing or replacing the Generator PT Cabinet surge arresters. One person concluded that the replacement would not have occurred because the surge arresters in the Generator PT cabinet were in a different operating environment.

Related Industry OE:

See Attachment 10.

Corrective Actions

Immediate/Interim Actions Completed	
Item #	**Action Taken**
N/A	The automatic generator lockout disconnected the generator from the grid, clearing the ground faults.
N/A	The fire brigade responded and extinguished the fire at the Main Transformer.
N/A	The operating crew entered the appropriate ON, OT and EOP procedures and performed the required actions.
N/A	The operating crew declared a Notification of Unusual Event per AP 3125 due to an unplanned in-plant fire lasting more than 10 minutes.
N/A	The operating crew made a 1-hour NRC notification per AP 0156 due to declaration of a Notification of Unusual Event, and a 4-hour NRC notification due to an RPS actuation when critical.

Proposed/Assigned Corrective Actions					
Item #	**Action**	**CA Type**	**Assigned Department**	**Due Date**	**CA #**
RC-2	Replace phase A, B, and C 22 kV surge arresters and capacitors prior to energizing the 22kV bus	CAPR	Project Engineering	Complete	06
RC-2	Include 22 kV surge arresters and capacitors in preventive maintenance program and define periodic testing requirements	CAPR	System Engineering	9/30/04	15
RC-1 CC-1	Replace phase A, B, and C 22 kV flexible connectors prior to energizing the 22kV bus	CAPR	Project Engineering	Complete	07
RC -1 CC-4	Perform a cleanliness closeout inspection of the 22 kV isophase bus duct prior to energizing the 22kV bus	CAPR	Project Engineering	Complete	08
RC-1	Enhance the 22 kV isophase bus preventive maintenance program and define periodic inspection requirements	CAPR	System Engineering	9/30/04	16
CC-2	Evaluate station procedural response to electrical bus grounds relative to fleet and industry standards and revise procedures accordingly	CA	Design Engineering	Complete	09
CC-2	Evaluate current plant design scheme for generator fault protection	EN	Design Engineering	09/30/04	17

Proposed/Assigned Corrective Actions					
Item #	**Action**	**CA Type**	**Assigned Department**	**Due Date**	**CA #**
CC-3	Initiate a Condition Report on inadequate industry operating experience response	CA	System Engineering	Complete	VTY-CR-2004-2183 / OEN-CR-2004-0225
CC-1	Complete testing and analysis of flexible connectors	EN	Code Programs	9/30/04	18
RC-2	Complete testing and lab analysis of the "B" bushing box debris	EN	Code Programs	9/30/04	19
RC-2	Complete testing and analysis of the arc strikes on the "B" isophase bus	EN	Code Programs	9/30/04	20
RC-2	Complete testing and analysis of the "B" isophase bus standoff insulator	EN	Code Programs	9/30/04	21
RC-1 RC-2	Initiate a Condition Report on ineffective Preventive Maintenance Program implementation	CA	System Engineering	7/23/04	22
CC-4	Evaluate FME procedural controls for electrical systems and revise procedures accordingly	CA	Maintenance Support	10/28/04	28
	Evaluate failure mechanism for the oil piping flange to the "C" Main Transformer turret	EN	Design Engineering	9/30/04	23
	Revise / amend the Root Cause Analysis Report based upon insights gained from lab testing / analysis	CA	Technical Support	10/28/04	24
	Initiate an ER to investigate the installation of digital fault recording equipment on the station 4 kV electrical distribution system. Consider synchronizing this equipment with the existing Beckwith Relays, ERFIS and the Relay House DFR.	EN	Design Engineering	09/30/04	25
	Identify and formalize increased monitoring requirements for the Main and Unit Auxiliary Transformers	EN	Design Engineering	Complete	10

Proposed/Assigned Corrective Actions					
Item #	**Action**	**CA Type**	**Assigned Department**	**Due Date**	**CA #**
	Increase transformer oil sampling frequencies (Main and UAT to weekly; Startup and Auto to monthly)	EN	Engineering Support	Complete	11
	Monitor the isophase bus duct system once assembly is complete and fans are running to ascertain whether vibration levels are acceptable	EN	Design Engineering	Complete	12
CC-3	Resolve the extent of condition questions related to OE associated with the K186, T3 1A/1B, and the Emergency Diesel Generator surge arrestors. Specifically justify why startup can commence with these arresters in their current condition	CA	Design Engineering	Complete	13
CC-3	Resolve the surge arrester Extent of Condition Evaluation recommendations identified in Attachment 13	CA	System Engineering	10/30/04	26
	Evaluate stopping isophase bus duct cooling fans on a faulted condition to minimize drawing smoke back into the Turbine Building	EN	Design Engineering	11/15/04	27
	Conduct an Effectiveness Review of Corrective Actions and present the results to CARB	LO	Technical Support	03/15/05	LO-VTYLO 2004-00391 CA-0001

Personnel Interviewed / Written Statement Providers:

K. Bassett - RCM
R. Bettini – Entergy Vermont Yankee
S. Bristol – Wackenhut
T. Cappelletti – Entergy Vermont Yankee
E. Carpenter - Wackenhut
L. Doane – Entergy Vermont Yankee
K. Gutkowski - Wackenhut
M. Castronova - Entergy Vermont Yankee
P. Corbett - Entergy Vermont Yankee
N. Jennison – Entergy Vermont Yankee
R. Keith – Entergy Vermont Yankee
E. Mayle – S. D. Meyers
P. McKenney – Entergy Vermont Yankee
L. Murphy – Entergy Vermont Yankee
B. Neilson – Entergy Vermont Yankee
K. Oliver – Entergy Vermont Yankee
J. Patrick - Entergy Vermont Yankee
J. Rawson - Wackenhut
B. Renney – Entergy Vermont Yankee
C. Rose - Entergy Vermont Yankee
R. Routhier – Entergy Vermont Yankee
T. Showers – Entergy Vermont Yankee
M. Sturtevant – Entergy Vermont Yankee
S. Thayer – Entergy Vermont Yankee
G. Wright – Entergy Vermont Yankee
D. Caristo – Wackenhut
P. Chapman – Entergy Vermont Yankee
A. Parker – Entergy Vermont Yankee
M. Mettell – Entergy Vermont Yankee
P.Perez – Entergy Vermont Yankee
D. Hickey – Wackenhut
L. Ervin – Wackenhut
R. Deprete – Wackenhut
Delta-Unibus Personnel
National Conductor Personnel

Keywords:

Transformer
Short Circuit
Ground [electrical]
Scram
Unusual Event Related 6/18/04
E-Plan
Nuclear Network Item
White Board Item
Cubicle
Design Issue
Degraded Equipment
Electrical Connection
Equipment Damage
Equipment Failure Evaluation
Fire Alarm
FME
Gasket
Obsolescence
PMT
Risk to Generation
Switchgear
Weld
HVAC
Isophase
Surge
Arrester
Flexible Link
Foreign Material

Attachments

1. Event Time Line
1A. Event Time Line Figures
2. Post-Trip Review
2A. Post Trip Report Support Data
3. Description of 22 kV Electrical System
4. Damage Assessment of 22 kV System
5. Electrical Transient Analysis
6. Equipment Failure Evaluation of Surge Arrester
7. Equipment Failure Evaluation of 22 kV Flexible Connector
7A. Examination of Bus Duct Flexible Connectors
8. Response to Fire
9. Results of Fire Investigation
10. Industry Operating Experience
11. Electrical Grid Conditions Prior to Event
12. Fault Tree Analysis
13. Surge Arrester Extent of Condition Evaluation
14. Plant Response to Ground Alarm on 06/17/2004
15. EPRI Analysis of Event
16. Phase "B" Fault Analysis
17. Barrier Analysis
18. CR-VTY-2004-2015 Related Condition Reports

ATTACHMENT 1
CR-VTY-2004-2015
Event Timeline

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	**Event Description**	**Additional Information**
6/17/04 06:53:52	The "GEN GND CURRENT HI" annunciator (7-A-2) alarms in the Control Room for approximately 50 seconds. ERFIS PTID G038 confirmed the presence of a 137-138 volt ground fault, as measured at the secondary of the Ground Fault Neutralizer Transformer.	Given that Line Voltage was 21.5kV at the time of the event, AND the primary-to-secondary tap setting of the Neutral Grounding Transformer is 19800V-to-240V, a solid ground fault would have resulted in G038 reading approximately 150 volts. Therefore, this ground was at 92% of the level of a solid ground fault.
6/17/04 07:00 approx.	VY Engineering, Operations, and Maintenance begin investigation of the ground fault.	
6/17/04 07:57:02	ERFIS PTID G038 spiked to 15 volts for one second.	This spike was confirmed to be coincident with a meter being temporarily placed across this circuit (i.e., not the result of a ground fault)
6/17/04 13:00	VY Team Meeting associated with 50-second ground fault event.	Based on the neutralizer secondary voltage being at 138v, it was concluded that the ground fault was located either on the 22kV System bus, or at the final 10% of the Main Generator, Main Transformer, or Unit Aux Transformer (UAT) 22kV Windings.
6/17/04 14:00	Telecon with GE regarding 50 second ground fault.	GE thought that fault "signature" may be indicative of one of the 22kV system surge capacitors shorting to ground.
6/17/04 15:00	Fleet Telecon associated with 50 second ground fault event.	
6/17/04 15:32	Operators swapped from "A" Generator Leads Fan to "B" Generator Leads Fan. Received Low Flow Alarm. Switched back to "A" Generator Lead Fan. Alarm cleared.	Initiated CR-VTY-2004-2000.

ATTACHMENT 1
CR-VTY-2004-2015
Event Timeline

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	**Event Description**	**Additional Information**
6/18/04 02:53:10	ERFIS PTID G038 spiked to 55 volts for two to three seconds.	
6/18/04 06:40:37 765 msec (3793 msec)	A momentary "B" phase-to-ground fault is recorded by the Beckwith Relay. The fault immediately clears within a few cycles.	A voltage spike with a magnitude of 116V RMS (at the secondary side of the Neutralizer Transformer) is measured by the Beckwith Relay.
6/18/04 06:40:38 T=0 (4028 msec)	The "B" phase begins to fault to ground intermittently. This results in "B" phase-to-ground voltage being reduced, with corresponding increases in "A" and "C" phase voltages (with respect to ground).	Ground fault current limited to a few amps by the ground fault neutralizer circuit.
6/18/04 06:40:38 102 msec (4130 msec)	As the "A" phase-to-ground voltage increases from 12.4kV towards 21.5kV, the "A" phase surge arrester begins to conduct, establishing the second phase-to-ground fault. This creates a short circuit path from "A" phase-to-ground-to-"B"-phase. Significant arcing occurs between the "B" phase and ground at the Main Transformer low voltage bushing box, simultaneous with the catastrophic failure of the "A" phase surge arrester.	The Beckwith Relay Data Acquisition System shows that Main Generator "A" and "B" phase amps momentarily increase to 650% of nominal. The Switchyard Digital Fault Recorder indicates "A" phase overcurrent in the 345/115kV Switchyard. The station's main phasor diagram confirms that a short circuit between the "A" and "B" phases on the 22kV system would result in an "A" phase overcurrent condition on the 345kV system. "C" Main Generator phase current remains constant for the next 5 cycles since it is not faulted at this point.

ATTACHMENT 1
CR-VTY-2004-2015
Event Timeline

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	**Event Description**	**Additional Information**
6/18/04 06:40:38 113 msec (4141 msec)	The instantaneous element of the 87/GMT "B" phase relay actuates and trips the Main Generator Backup Lockout Relay.	The differential element for all three 87/GMT relays was tripped in addition to the "B" phase instantaneous element. Based upon discussion with Design Engineering, the instantaneous element is the fastest of the two types and actuates within one cycle.
6/18/04 06:40:38 113-196 msec (4141-4224 msec)	Over this 5-cycle period, 22kV voltage decreases to less than 50% of nominal levels due to the "A" phase-to-ground-to "B"-phase fault. This event resulted in corresponding voltage reductions in the 4kV system.	Within a few milliseconds of the fault, the Bus 1 and 2 Synch Check Relays indicate a loss of synchronism between the Unit Auxiliary (UAT) and Startup Transformers.
6/18/04 06:40:38 196 msec (4224 msec)	The following breakers trip within a few milliseconds of each other to de-energize the 22kV system: ? Generator Field Breaker ? Aux Transformer Breaker 12 ? Aux Transformer Breaker 22 ? Main Generator Breaker 1T ? Main Generator Breaker 81-1T	The opening of the 81-1T and 1T breakers terminates the fault current contribution from the Main Transformer. Essentially, **the Main Transformer was exposed to fault current for only 5 to 6 cycles.** From this point on, the fault is only supplied from the decaying Main Generator Stator/Field.
6/18/04 06:40:38 197 msec (4225 msec)	Main Generator "C" phase current drops from nominal levels to approximately zero due to isolation of the generator from the 345kV and 4kV systems. The fault between the "A" and "B" phases continues.	

ATTACHMENT 1
CR-VTY-2004-2015
Event Timeline

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	**Event Description**	**Additional Information**
6/18/04 06:40:38 247 msec (4275 msec)	The Main Generator Primary Lockout Relay Trips due to actuation of the Main Transformer Fault Pressure Relay. No additional equipment actuations occur since the Primary and Backup Lockout relays perform the same functions.	Based on satisfactory testing and oil analysis of the Main Transformer, it is concluded that the Fault Pressure Relay was spuriously triggered by a pressure pulsation within the low voltage bushing box (as opposed to perturbations internal to the Main Transformer).
6/18/04 06:40:38 301-304 msec (4329-4332 msec)	Both Channels of RPS are received for a full Reactor SCRAM.	The ERFIS Sequence of Events Log indicates that the Main Generator Load Reject Scram Signal was received prior to the Turbine Stop Valve Closure Scram signal.

ATTACHMENT 1
CR-VTY-2004-2015
Event Timeline

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	**Event Description**	**Additional Information**
6/18/04 06:40:38 425 msec (4453 msec)	Bus 2 voltage reaches the setpoint of Residual Bus Voltage Relay 27R/2 (i.e., 1000 volts). 4kV Breaker 23 Closes to re-energize Bus 2. Bus 2 voltage immediately recovers from 1000 volts to 3200 volts. [Note: over the next ten seconds, Bus 2 voltage increases from 3200 to 4000 volts as motor in-rush current subsides.] It is believed that the "B" Recirc Pump MG Lube Oil control power fuses blew at this point.	ERFIS Data indicates that transfer of Bus 2 from the UAT to the Startup Transformers occurred in approximately 14 cycles. This time period is backed up by the Switchyard Digital Fault Recorder that monitors T-3-1B load current. Previous 4kV Bus "Fast Transfers" have been recorded at 4 to 5 cycles. The "Residual Bus Transfer" occurred due to the loss of synchronism between the two sources when the 22kV system faults occurred. Note: The "C" Feed Pump did not receive a trip signal during the residual bus transfer because Breaker 23 closed within 0.3 seconds of Breaker 22 opening.

ATTACHMENT 1
CR-VTY-2004-2015
Event Timeline

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	**Event Description**	**Additional Information**
6/18/04 06:40:38 478 msec (4506 msec)	Bus 1 voltage reaches the setpoint of Residual Bus Voltage Relay 27R/1 (i.e. 1000 volts). Startup Transformer Breaker 13 closes to re-energize Bus 1. Bus 1 voltage immediately recovers from 1000 volts to 3100 volts. [Note: over the next six seconds, Bus 1 voltage increases from 3100 to 4000 volts as motor in-rush current subsides.] It is believed that the "A" Recirc Pump Recirc MG Lube Oil control power fuses blew at this point.	ERFIS Data indicates that the transfer of Bus 1 from the UAT to the Startup Transformers occurred in approximately 18 cycles. Previous 4kV Bus "Fast Transfers" have been recorded at 4 to 5 cycles. The "Residual Bus Transfer" occurred due to the loss of synchronism between the two sources when the 22kV system faults occurred. Note: ERFIS data (1 second resolution) for Breaker 13 and "A" and "B" Feed Pump breakers indicates that the "A" Feed Pump tripped and the "B" Feed Pump started within one second of Breaker 13 closing. Based on this information and review of CWD 317 & 317A, it is concluded that the "A" Feed pump was tripped by the Residual Bus Transfer circuit 0.3 seconds after Breaker 12 opened. The "A" Feed pump trips due to actuation of 0.3-second Time Delay Pickup (TDPU) Relay 2/1-1. This relay is actuated if Breaker 12 and 13 are both open for 0.3 seconds (i.e. 18 cycles).

ATTACHMENT 1
CR-VTY-2004-2015
Event Timeline

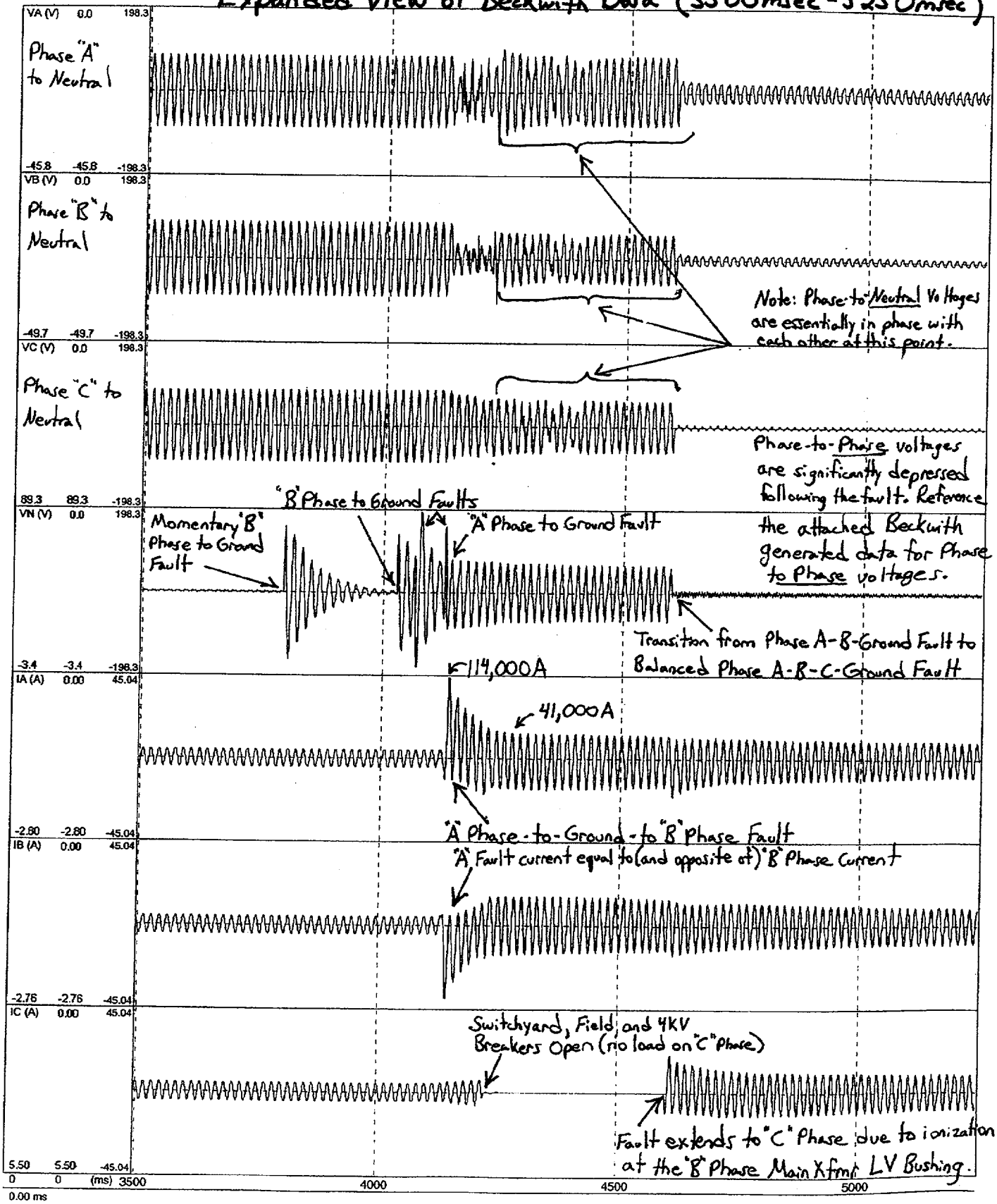
Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	**Event Description**	**Additional Information**
6/18/04 06:40:38 572 msec (4600 msec)	Arcing/Ionization at the "B" phase of the Main Transformer Low voltage bushing box carries over to the "C" phase and initiates a fault at this location.	At this point, the fault appears to be relatively balanced between all three phases. "A", "B", and "C" phase currents are now approximately 120 degrees out of phase with respect to each other.
6/18/04 06:40:45	The 4kV Supply Breakers to the "A" and "B" Recirc Motor Generators (MGs) trip.	The subject 4kV breakers trip on low MG system oil pressure following a six second time delay. Reference CWDs 700-725. [Note: The running MG oil pumps tripped at the onset of the event.]
6/18/04 06:40:45	ERFIS Data indicates that Main Generator field and stator currents have decayed to zero approximately 6 to 7 seconds after field breaker opening.	**Fault current at the "A" compartment of the Generator PT Cabinet and the Main Transformer low voltage bushing box is terminated at this point in the timeline.**
6/18/04 06:41	Fire Brigade responding to Main Transformer fire.	
6/18/04 06:41:03	"B" Feed Pump secured.	
6/18/04 06:41:34	"C" Feed Pump trips due to Reactor High Water Level signal.	
6/18/04 06:42	Mode Switch placed in SHUTDOWN	
6/18/04 06:46	Main Transformer deluge valve actuation	
6/18/04 06:50	Notification of Unusual Event (NOUE) declared due to an unplanned on-site fire not extinguished within 10 minutes (U-4-a)	
6/18/04 06:52	Fire Brigade on the scene.	
6/18/04 07:05	Vernon Fire Department on-site	
6/18/04 07:07	Brattleboro Fire Department on-site	

ATTACHMENT 1
CR-VTY-2004-2015
Event Timeline

Event Time (Beckwith Relay Timestamp in parenthesis where applicable)	**Event Description**	**Additional Information**
6/18/04 07:15	Rescue within the Protected Area on standby.	
6/18/04 07:11	Initiated notification of NH, VT, and MA	
6/18/04 07:15	Foam being applied to Main Transformer	
6/18/04 07:17	Fire extinguished	
6/18/04 08:10	Placed East & West Switchgear Room CO2 Systems in abort due to transient smoke in the rooms.	
6/18/04 08:55	Returned Security loads to Bus 11 and secured JDDG. Prior to this, power was being intermittently lost at Gate 2.	Note: These loads were cycling due to an apparent transfer switch malfunction.
6/18/04 09:10	Commenced Reactor cooldown at 20-60 deg F / hour.	
6/18/04 09:47	Report of hydrogen fire at valve SO-29 near the isophase bus duct cooling unit. Fire Brigade responding.	
6/18/04 09:52	Fire extinguished with portable extinguisher.	
6/18/04 10:20	Notified by Liason Engineer that fire area is considered a crime scene at Homeland Security's recommendation.	No evidence of sabotage was found.
6/18/04 12:45	Notification of Unusual Event (NOUE) terminated.	

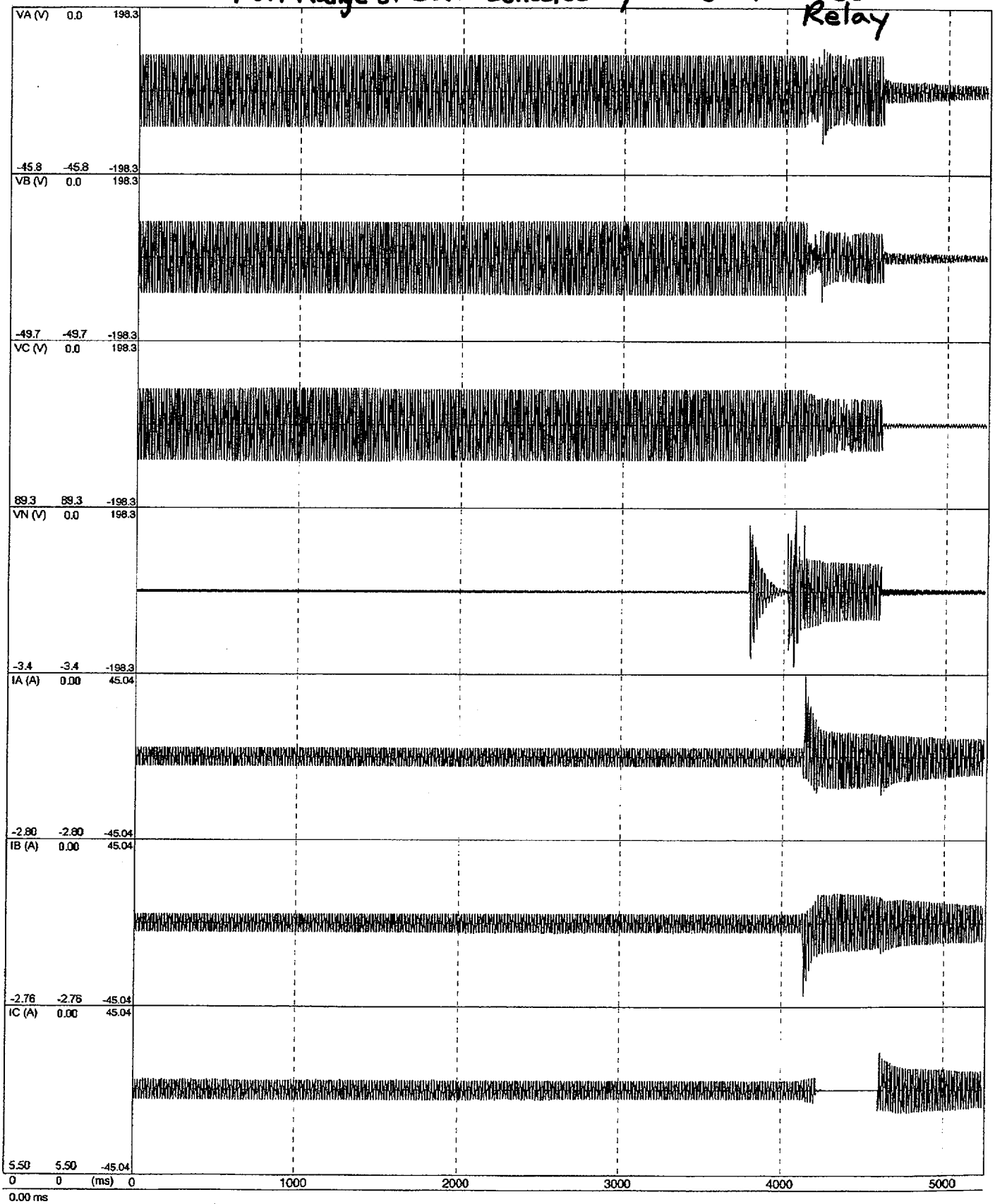
M3425A BECKWITH ELECTRIC CO.
File name: C:\Documents and Settings\damidon\Desktop\IPS Plot Data\VYgen618.OSC
Start at: 06/18/2004, 06:37:42.908
Tripped at: 06/18/2004, 06:37:47.651

Expanded View of Beckwith Data (3500msec - 5250msec)



M3425A BECKWITH ELECTRIC CO.
File name: C:\Documents and Settings\damidon\Desktop\IPS Plot Data\VYgen618.OSC
Start at: 06/18/2004, 06:37:42.908
Tripped at: 06/18/2004, 06:37:47.651

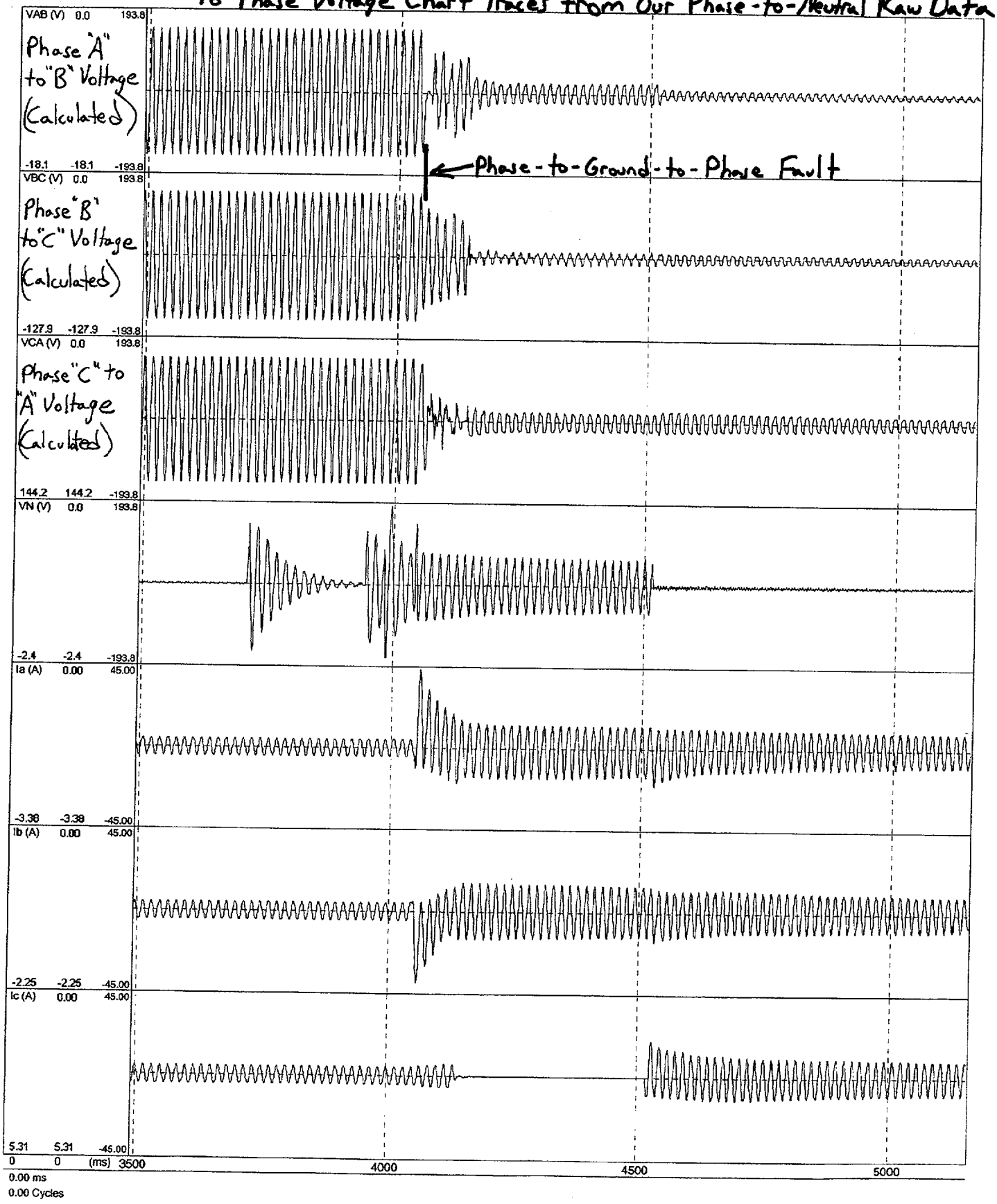
Full Range of Data Collected By The Beckwith Generator Relay



0.00 ms
0.00 Cycles

M3425A BECKWITH ELECTRIC CO.
File name: C:\Documents and Settings\damidon\Desktop\IPS Plot Data\REPLAY1.cfg
Start at: ~~01/01/2001, 01:01:20.000~~
Tripped at: ~~01/01/2001, 01:01:20.000~~

Beckwith Engineering Developed These Phase-to-Phase Voltage Chart Traces from Our Phase-to-Neutral Raw Data

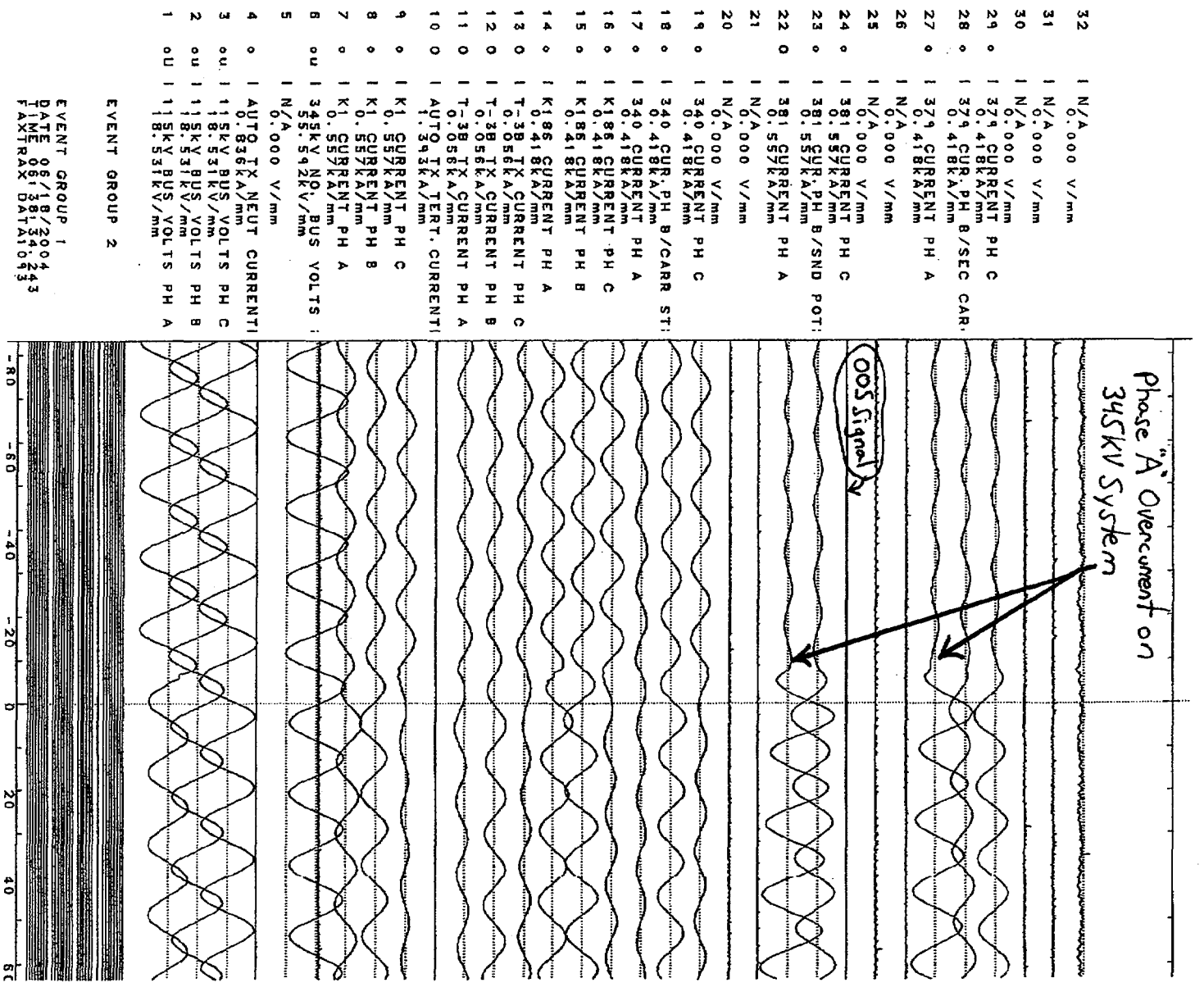


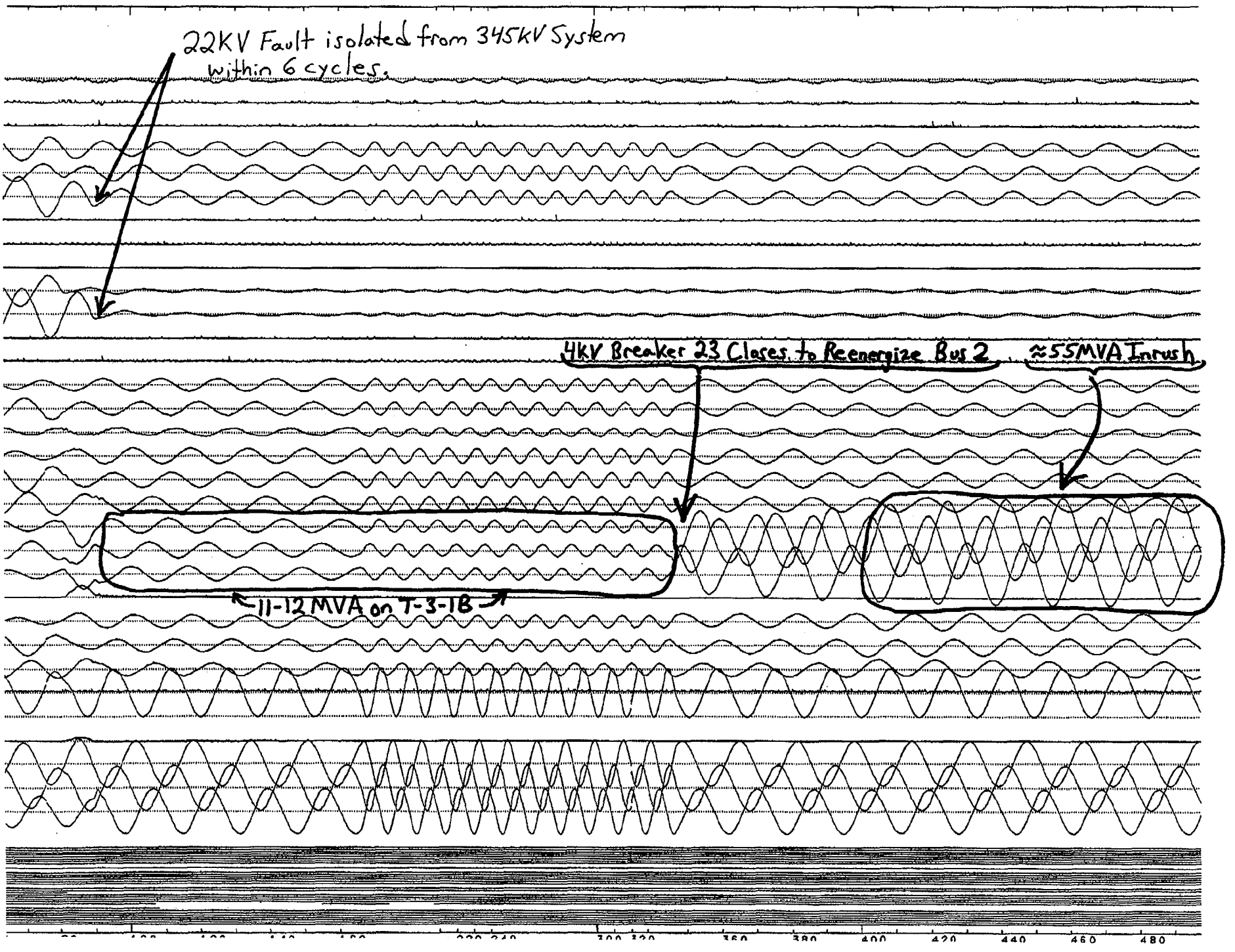
VERMONT YANKEE SUBSTATION
DIGITAL FAULT RECORDER
Attention:Engineering Department

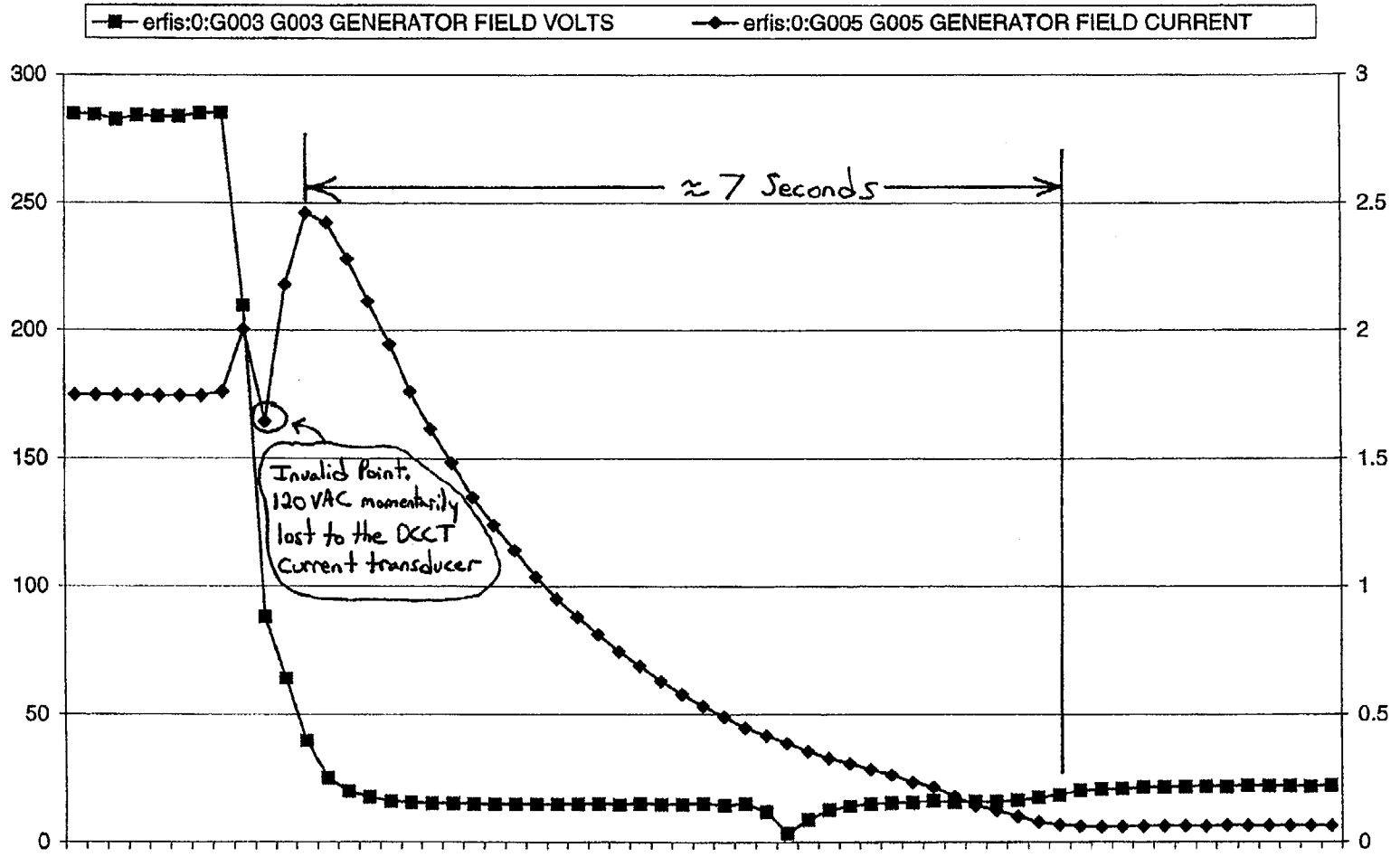
JUNE 18, 2004 RTC TIME 06:38:34.243 RECORD NUMBER 1093

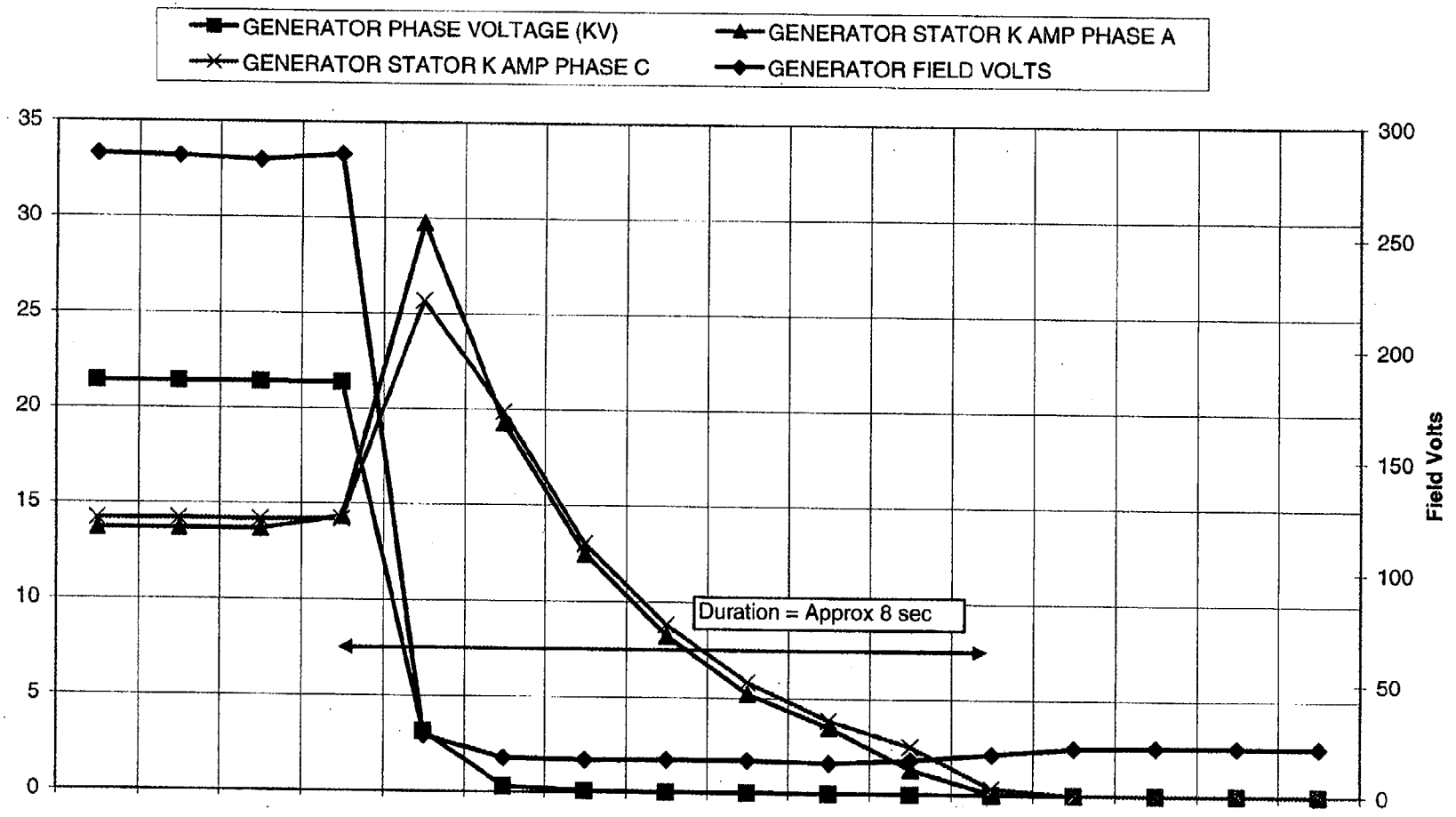
RECORDER DATA SUMMARY

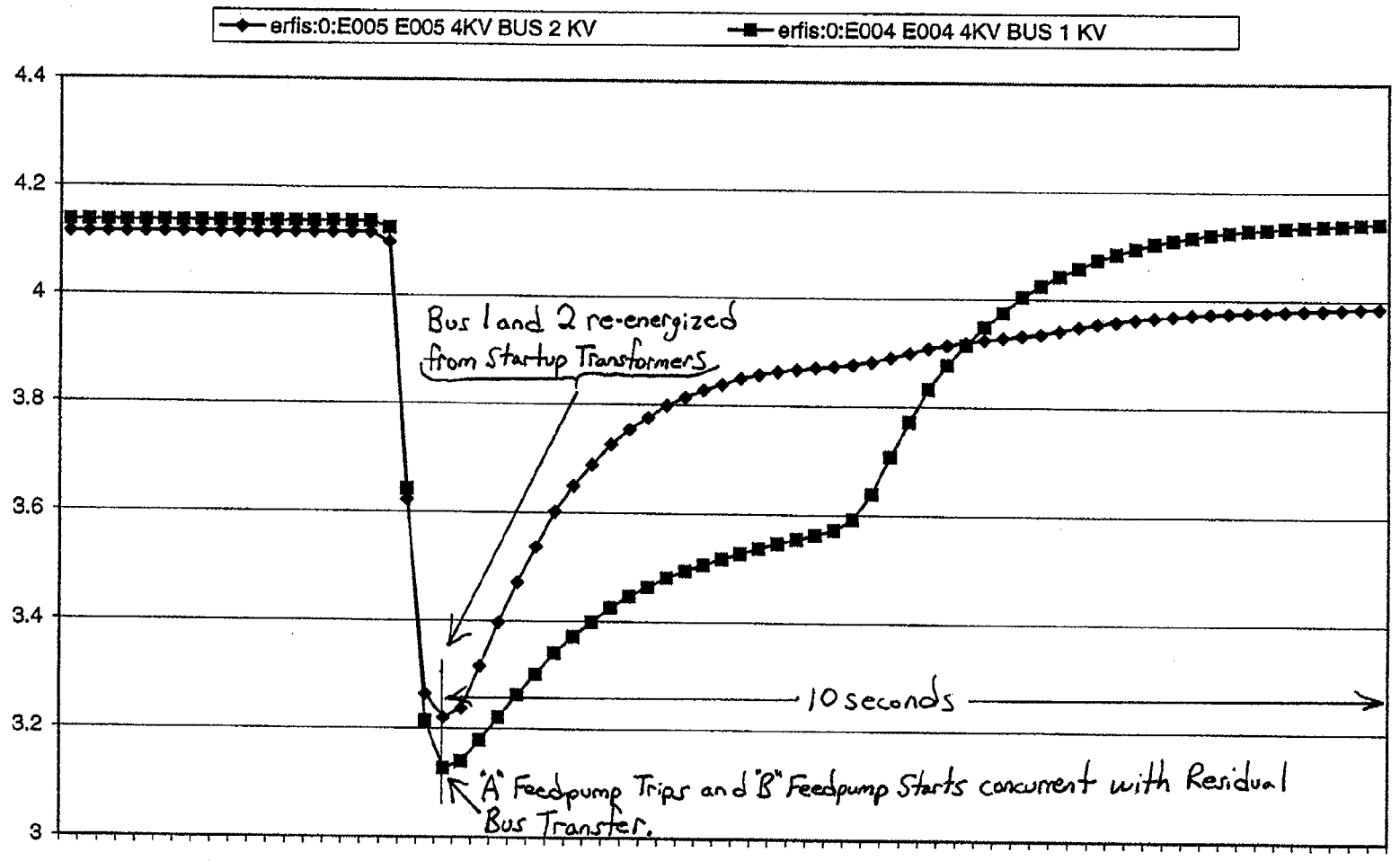
		CHANNEL NAME	TYPE	VALUE	START	DURATION	RMS(.5-1.5cy)	
	27	379 CURRENT PH A	OVER	2.845kA	34.243	0.007	1.404kA	Phase A to Ground to Phase B fault on 22KV System
	22	381 CURRENT PH A	OVER	4.628kA	34.243	0.008	2.332kA	
	1	115kV BUS VOLTS PH A	UNDER	66.64kV	34.254	0.083		
	22	381 CURRENT PH A	OVER	4.628kA	34.260	0.072	2.332kA	
	27	379 CURRENT PH A	OVER	2.845kA	34.260	0.030	1.404kA	
EVENT	14	ATB 81-1T BKR POSIT	ALARM	———	34.324	0.000	———	← 81-1T opens
	10	AUTO TX TERT.CURRENT	OVER	3.574kA	34.325	0.020	———	
EVENT	9	K186 CARRIER ON	ALARM	———	34.350	0.048	———	
EVENT	8	1T BKR POSITION	ALARM	———	34.351	0.000	———	← 1T opens
EVENT	9	K186 CARRIER ON	RTN	———	34.398	———	———	
EVENT	9	K186 CARRIER ON	ALARM	———	34.424	0.026	———	
EVENT	9	K186 CARRIER ON	RTN	———	34.450	———	———	
	11	T-3B TX CURRENT PH A	OVER	0.372kA	34.589	0.007		Residual Bus 2 Transfer to T-3-1B
	13	T-3B TX CURRENT PH C	OVER	0.573kA	34.590	0.010		
	12	T-3B TX CURRENT PH B	OVER	0.504kA	34.594	0.008		
	11	T-3B TX CURRENT PH A	OVER	0.372kA	34.606	0.409		
	13	T-3B TX CURRENT PH C	OVER	0.573kA	34.607	0.009		
	12	T-3B TX CURRENT PH B	OVER	0.504kA	34.610	0.418		
	13	T-3B TX CURRENT PH C	OVER	0.573kA	34.624	0.402		




22KV Fault isolated from 345kV System within 6 cycles.
4KV Breaker 23 Closes to Reenergize Bus 2
≈55MVA Inrush
11-12 MVA on T-3-1B
360
380
400
420
440
460
480


erfis:0:G003 G003 GENERATOR FIELD VOLTS
erfis:0:G005 G005 GENERATOR FIELD CURRENT
300
250
200
150
100
50
0
3
2.5
2
1.5
1
0.5
0
≈ 7 Seconds
Invalid Point.
120 VAC momentarily
lost to the DCCT
current transducer


GENERATOR PHASE VOLTAGE (KV)
GENERATOR STATOR K AMP PHASE A
GENERATOR STATOR K AMP PHASE C
GENERATOR FIELD VOLTS
35
30
25
20
15
10
5
0
300
250
200
150
100
50
0
Field Volts
Duration = Approx 8 sec


erfis:0:E005 E005 4KV BUS 2 KV
erfis:0:E004 E004 4KV BUS 1 KV
4.4
4.2
4
3.8
3.6
3.4
3.2
3
Bus 1 and 2 re-energized from Startup Transformers
10 seconds
"A" Feedpump Trips and "B" Feedpump Starts concurrent with Residual Bus Transfer.

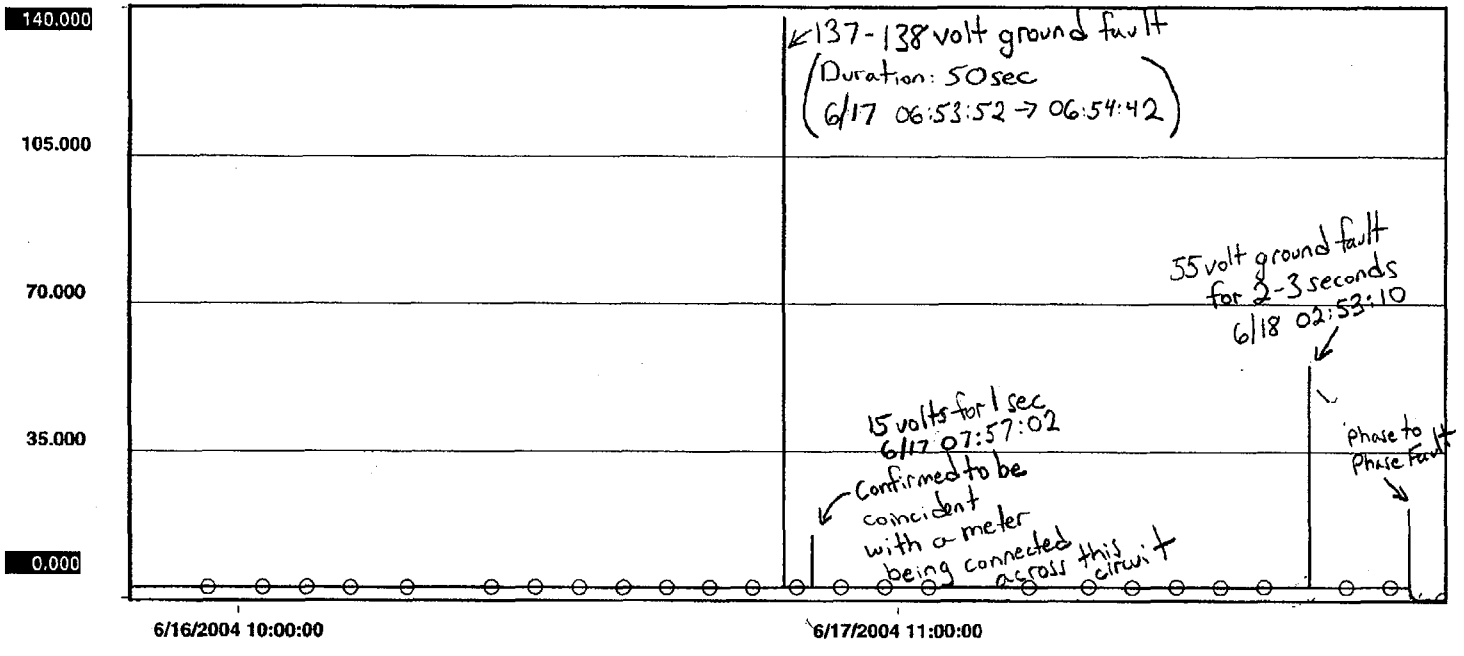
VTY	CTP	PLANT MODE
PSS	0.5 %	SHUTDOWN

One Two-Variable Trend

TREND_2 6/28/2004 13:54:45

Start Time: 6/16/2004 6:00:00
End Time: 6/18/2004 8:00:00

Archive Sample Rate: 1 second
Real-Time Sample Rate: 1 hour



Pt. Name 1: G038 GROUND FAULT NEUTRAL VOLTAGE 0.009 VOLT ○

Pt. Name 2: △

18-JUN-04 06:40:38 SEP	06:40:38.247	D580	GEN TRIP-UNIT DIFF		TRIP	U 1
18-JUN-04 06:40:38 SEP	06:40:38.191	M560	RRU MOTOR 1A		OFF	OK 0
18-JUN-04 06:40:38 SEP	06:40:38.193	M562	RRU MOTOR 2A		OFF	OK 0
18-JUN-04 06:40:38 SEP	06:40:38.195	M576	RRU MOTOR 4A		OFF	OK 0
18-JUN-04 06:40:38 SEP	06:40:38.200	M574	RRU MOTOR 3A		OFF	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.249	D619	BUS 1/T3A SYNCH TRANSFER		LOSS	U 0
18-JUN-04 06:40:39 SEP	06:40:38.250	D620	BUS 2/T3B SYNCH TRANSFER		LOSS	U 0
18-JUN-04 06:40:39 SEP	06:40:38.270	D580	GEN TRIP-UNIT DIFF		NORM	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.287	D588	GEN TRIP-BACKUP LOCKOUT RELAY		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.291	D598	GENERATOR FIELD BREAKER		OPEN	U 1
18-JUN-04 06:40:39 SEP	06:40:38.295	D591	AUX XFMR BREAKER 12 (BUS 1)		OPEN	U 1
18-JUN-04 06:40:39 SEP	06:40:38.295	D592	AUX XFMR BREAKER 22 (BUS 2)		OPEN	U 1
18-JUN-04 06:40:39 SEP	06:40:38.296	D597	GENERATOR BREAKER 1T		OPEN	U 1
18-JUN-04 06:40:39 SEP	06:40:38.299	D596	GENERATOR BREAKER 81-1T		OPEN	U 1
18-JUN-04 06:40:39 SEP	06:40:38.301	D596	GENERATOR BREAKER 81-1T		CLOSE	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.302	D596	GENERATOR BREAKER 81-1T		OPEN	U 1
18-JUN-04 06:40:39 SEP	06:40:38.304	D596	GENERATOR BREAKER 81-1T		CLOSE	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.304	D596	GENERATOR BREAKER 81-1T		OPEN	U 1
18-JUN-04 06:40:39 SEP	06:40:38.317	D583	GEN TRIP-MAIN XFMR PRESSURE		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.334	D605	TURB TRIP-VACUUM TRIP #1		TRIP	U 0
18-JUN-04 06:40:39 SEP	06:40:38.371	D534	REACTOR AUTO SCRAM A		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.374	D561	REACTOR AUTO SCRAM B		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.381	D623	GEN TRIP-PRIMARY LOCKOUT RELAY		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.393	D541	GEN LOAD REJ SCRAM C		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.395	D541	GEN LOAD REJ SCRAM C		NORM	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.396	D539	GEN LOAD REJ SCRAM A		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.399	D542	GEN LOAD REJ SCRAM D		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.400	D542	GEN LOAD REJ SCRAM D		NORM	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.401	D542	GEN LOAD REJ SCRAM D		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.401	D541	GEN LOAD REJ SCRAM C		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.401	D539	GEN LOAD REJ SCRAM A		NORM	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.403	D542	GEN LOAD REJ SCRAM D		NORM	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.405	D539	GEN LOAD REJ SCRAM A		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.408	D540	GEN LOAD REJ SCRAM B		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.413	D542	GEN LOAD REJ SCRAM D		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.414	D539	GEN LOAD REJ SCRAM A		NORM	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.428	D539	GEN LOAD REJ SCRAM A		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.278	M561	RRU MOTOR 1B		OFF	OK 0
18-JUN-04 06:40:39 SEP	06:40:38.278	E540	UPS-2A TRIP		TRIP	U 1
18-JUN-04 06:40:39 SEP	06:40:38.286	M536	ISOLATION GROUP 2 A LOGIC		ISOL	U 0
18-JUN-04 06:40:39 SEP	06:40:38.290	M536	ISOLATION GROUP 2 A LOGIC		NORM	OK 1
18-JUN-04 06:40:39 SEP	06:40:38.291	M536	ISOLATION GROUP 2 A LOGIC		ISOL	U 0

Phase "A" to "B" Fault sensed by Protective Relaying.

18-JUN-04	06:40:39 SEP	06:40:38.325	M535	ISOLATION GROUP 1 INBOARD	ISOL	U	0
18-JUN-04	06:40:39 SEP	06:40:38.484	D537	TSV 3 OR 4 CLOSURE SCRAM	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.489	D599	STEAM BYPASS VALVE ODD	OPEN	U	0
18-JUN-04	06:40:39 SEP	06:40:38.497	D535	TSV 1 OR 2 CLOSURE SCRAM	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.500	D538	TSV 2 OR 4 CLOSURE SCRAM	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.506	D536	TSV 1 OR 3 CLOSURE SCRAM	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.510	D600	STEAM BYPASS VALVE EVEN	OPEN	U	0
18-JUN-04	06:40:39 SEP	06:40:38.518	D603	TURBINE STOP VALVE 3	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.524	D594	STARTUP XFMR BREAKER 23 (BUS 2)	CLOSE	U	0
18-JUN-04	06:40:39 SEP	06:40:38.538	D601	TURBINE STOP VALVE 1	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.538	D601	TURBINE STOP VALVE 1	OPEN	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.542	D601	TURBINE STOP VALVE 1	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.542	D601	TURBINE STOP VALVE 1	OPEN	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.558	D604	TURBINE STOP VALVE 4	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.563	D601	TURBINE STOP VALVE 1	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.565	D604	TURBINE STOP VALVE 4	OPEN	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.566	D604	TURBINE STOP VALVE 4	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.570	D601	TURBINE STOP VALVE 1	OPEN	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.572	D601	TURBINE STOP VALVE 1	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.573	D601	TURBINE STOP VALVE 1	OPEN	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.577	D601	TURBINE STOP VALVE 1	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.577	D593	STARTUP XFMR BREAKER 13 (BUS 1)	CLOSE	U	0
18-JUN-04	06:40:39 SEP	06:40:38.595	D602	TURBINE STOP VALVE 2	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.753	D620	BUS 2/T3B SYNCH TRANSFER	NORM	OK	1
18-JUN-04	06:40:39 SEP	06:40:38.803	D619	BUS 1/T3A SYNCH TRANSFER	NORM	OK	1
18-JUN-04	06:40:40 SEP	06:40:40.222	D612	STATOR COOLING TURB TRIP TIMER	STRT	U	1
18-JUN-04	06:40:44 SEP	06:40:44.969	D521	REACTOR WATER LEVEL SCRAM B	LOW	U	1
18-JUN-04	06:40:45 SEP	06:40:45.206	D523	REACTOR WATER LEVEL SCRAM D	LOW	U	1
18-JUN-04	06:40:45 SEP	06:40:45.311	D522	REACTOR WATER LEVEL SCRAM C	LOW	U	1
18-JUN-04	06:40:45 SEP	06:40:45.312	D522	REACTOR WATER LEVEL SCRAM C	NORM	OK	0
18-JUN-04	06:40:45 SEP	06:40:45.317	D522	REACTOR WATER LEVEL SCRAM C	LOW	U	1
18-JUN-04	06:40:46 SEP	06:40:46.377	D520	REACTOR WATER LEVEL SCRAM A	LOW	U	1
18-JUN-04	06:40:46 SEP	06:40:46.872	D612	STATOR COOLING TURB TRIP TIMER	NORM	OK	0
18-JUN-04	06:40:47 SEP	06:40:47.624	D600	STEAM BYPASS VALVE EVEN	CLOSE	OK	1
18-JUN-04	06:40:48 SEP	06:40:49.037	D599	STEAM BYPASS VALVE ODD	CLOSE	OK	1
18-JUN-04	06:41:03 SEP	06:40:38.605	M560	RRU MOTOR 1A	OFF	OK	0
18-JUN-04	06:41:03 SEP	06:40:38.605	M561	RRU MOTOR 1B	OFF	OK	0
18-JUN-04	06:41:03 SEP	06:40:38.605	M562	RRU MOTOR 2A	OFF	OK	0
18-JUN-04	06:41:03 SEP	06:40:38.605	M576	RRU MOTOR 4A	OFF	OK	0
18-JUN-04	06:41:03 SEP	06:40:38.605	E540	UPS-2A TRIP	TRIP	U	1
18-JUN-04	06:41:03 SEP	06:40:38.605	E541	UPS-2A SUMMARY ALARM	NORM	OK	0
18-JUN-04	06:41:03 SEP	06:40:38.611	M576	RRU MOTOR 4A	ON	U	1

18-JUN-04	06:41:03 SEP	06:40:38.611	E540	UPS-2A TRIP	NORM	OK	0
18-JUN-04	06:41:03 SEP	06:40:38.667	E541	UPS-2A SUMMARY ALARM	ALARM	U	1
18-JUN-04	06:41:03 SEP	06:40:38.670	M561	RRU MOTOR 1B	ON	U	1
18-JUN-04	06:41:04 SEP	06:40:39.272	M560	RRU MOTOR 1A	ON	U	1
18-JUN-04	06:41:06 SEP	06:41:06.318	D523	REACTOR WATER LEVEL SCRAM D	NORM	OK	0
18-JUN-04	06:41:08 SEP	06:41:08.658	D522	REACTOR WATER LEVEL SCRAM C	NORM	OK	0
18-JUN-04	06:41:08 SEP	06:41:08.967	D503	SDV HIGH WATER LEVEL SCRAM D	HIGH	U	1
18-JUN-04	06:41:08 SEP	06:41:08.970	D503	SDV HIGH WATER LEVEL SCRAM D	NORM	OK	0
18-JUN-04	06:41:08 SEP	06:41:08.972	D503	SDV HIGH WATER LEVEL SCRAM D	HIGH	U	1
18-JUN-04	06:41:08 SEP	06:41:08.981	D503	SDV HIGH WATER LEVEL SCRAM D	NORM	OK	0
18-JUN-04	06:41:08 SEP	06:41:08.983	D503	SDV HIGH WATER LEVEL SCRAM D	HIGH	U	1
18-JUN-04	06:41:08 SEP	06:41:09.026	D500	SDV HIGH WATER LEVEL SCRAM A	HIGH	U	1
18-JUN-04	06:41:08 SEP	06:41:09.032	D501	SDV HIGH WATER LEVEL SCRAM B	HIGH	U	1
18-JUN-04	06:41:08 SEP	06:41:09.032	D501	SDV HIGH WATER LEVEL SCRAM B	NORM	OK	0
18-JUN-04	06:41:08 SEP	06:41:09.037	D501	SDV HIGH WATER LEVEL SCRAM B	HIGH	U	1
18-JUN-04	06:41:08 SEP	06:41:09.040	D502	SDV HIGH WATER LEVEL SCRAM C	HIGH	U	1
18-JUN-04	06:41:09 SEP	06:41:09.827	D521	REACTOR WATER LEVEL SCRAM B	NORM	OK	0
18-JUN-04	06:41:10 SEP	06:41:10.211	D599	STEAM BYPASS VALVE ODD	OPEN	U	0
18-JUN-04	06:41:10 SEP	06:41:10.593	D520	REACTOR WATER LEVEL SCRAM A	NORM	OK	0
18-JUN-04	06:41:13 SEP	06:41:13.169	D634	SCRAM AIR HDR TRIP OF MTS-1	LOW	U	1
18-JUN-04	06:41:34 SEP	06:41:34.174	D629	TURB TRIP-HIGH REACTOR WATER LVL	TRIP	U	1
18-JUN-04	06:41:34 SEP	06:41:35.103	E502	RX FEED PUMP C MOTOR BREAKER	OPEN	U	0
18-JUN-04	06:41:51 SEP	06:41:52.126	E541	UPS-2A SUMMARY ALARM	NORM	OK	0
18-JUN-04	06:41:57 SEP	06:41:58.071	D556	MODE SWITCH IN STARTUP POSITION	YES	U	1
18-JUN-04	06:41:57 SEP	06:41:58.076	D555	MODE SWITCH IN RUN POSITION	NO	U	1
18-JUN-04	06:41:57 SEP	06:41:58.105	D556	MODE SWITCH IN STARTUP POSITION	NO	OK	0
18-JUN-04	06:41:57 SEP	06:41:58.236	D533	REACTOR MANUAL SCRAM B	TRIP	U	1
18-JUN-04	06:41:57 SEP	06:41:58.242	D532	REACTOR MANUAL SCRAM A	TRIP	U	1
18-JUN-04	06:44:20 SEP	06:44:20.365	E541	UPS-2A SUMMARY ALARM	ALARM	U	1
18-JUN-04	06:44:33 SEP	06:44:34.005	E541	UPS-2A SUMMARY ALARM	NORM	OK	0
18-JUN-04	06:46:10 SEP	06:46:10.681	E508	CONDENSATE PUMP C MOTOR BREAKER	OPEN	U	1
18-JUN-04	06:48:21 SEP	06:48:21.233	E541	UPS-2A SUMMARY ALARM	ALARM	U	1
18-JUN-04	06:48:25 SEP	06:48:25.398	E541	UPS-2A SUMMARY ALARM	NORM	OK	0
18-JUN-04	06:48:58 SEP	06:48:58.941	E541	UPS-2A SUMMARY ALARM	ALARM	U	1
18-JUN-04	06:49:08 SEP	06:49:09.062	E541	UPS-2A SUMMARY ALARM	NORM	OK	0
18-JUN-04	06:50:07 SEP	06:50:07.153	D629	TURB TRIP-HIGH REACTOR WATER LVL	NORM	OK	0

POST TRIP REPORT

Trip Date: 6-18-04 Report No.: _____ (Report No. to be assigned before filing - Final Conditions 4.a)

PERSONNEL

Duty Shift Manager: LEDoane/ADZander(UI)
Duty CRS: BJCroke/VSFerrizzi(UI)
Duty CRO: JPShepherd
Duty ACRO: WEManning(1)
Duty ACRO:
Duty STA: ATWisniewski
Duty AOs: WEManning(2) VERoll
TAShowers, M Flory
Others Involved:

INITIAL CONDITIONS (Data from Control Room Recorders/Printers or ERFIS).

Reactor Power (MWt) 1592 (C047)
Reactor Vessel Press (psig/psia) 1013 / 1028 (B025/BOP013*)
Reactor Vessel level (in) 159.6 (B021)
Reactor Core Flow (M#/hr) 46.5 (B012)

Mode Switch Position: Startup _____ Run ✓

Status of Control Systems:

Recirc Pump Control: Master Manual ✓ (CRO)
A Pump MAN ____ BAL ____ AUTO ✓ 89.0 % Speed (CRO/M040/M136)
B Pump MAN ____ BAL ____ AUTO ✓ 94.0 %Speed (CRO/M041/M137)

Vessel Level Control: Single Element ____ 3 Element ✓
A Side ____ B Side ✓
A Feed Reg Vlv In Service ✓
B Feed Reg Vlv In Service ✓
10% Feed Reg Vlv In Service N/A

Pressure Control: EPR ✓ MPR ____

* This computer point is in psia.

INITIAL CONDITIONS (Continued)

Status of Nuclear Instrumentation

		OPERABLE	INOPERABLE	BYPASSED
APRM	A	✓		
	C	✓		
	E	✓		
	B	✓		
	D	✓		
	F	✓		
IRM	A	✓		
	C	✓		
	E	✓		
	B	✓		
	D	✓		
	F	✓		
SRM	A	✓		
	C	✓		
	B	✓		
	D	✓		

Off normal status of any portions of safety systems prior to trip: None

Testing/Surveillance in Progress: None

Other significant initial conditions:

① On 6/17/04 at 06:53 CRP Annunciator 7-A-2 (Generator Ground Current High) was received. See CR-VTY-2004-1989 for details. CR attached. Troubleshooting and investigation was underway during the day of 6/17/04. A team was assembled and further troubleshooting was planned for 6/18/04. The ground cleared within ≈ 1 minute. Concurrent with the 7-A-2 alarm, an AOG and HVAC Trouble alarm was received and cleared.

② On 6/18/04 at 02:37, the AOG and HVAC Trouble alarms were received and cleared. No Generator Ground Current High alarm was received for no apparent reason

EVENT RECONSTRUCTION

Attach a copy of the applicable parameter plots given below:

(Use the medium that best depicts the transient response. Suggested ERFIS PTIDs are identified in the order of preference if multiple PTIDs are available).

	Check if Included		Parameter
1.	✓	1.	APRM A, B, C, D, E, F (B000, B003, B001, B004, B002, B005)
2.	✓	*2.	Reactor Vessel Level
3.	✓	3.	Reactor Vessel Pressure (B025/BOP013**)
4.	✓	4.	Reactor Core Flow (B012)
5.	✓	5.	Steam Flow (C000/B022)
6.	✓	6.	Feedwater Flow (A&B lines) A: (B015/C098/C002) B: (B016/C099/C003)
7.	✓	7.	Feedwater Temperature (A&B lines) A: (B030/B031) B: (B032/B033)
8.	✓	8.	Control/Bypass Valve Position CV: (T004) BPV: (T026)
9.	✓	9.	Drywell Pressure (C204)
10.	✓	10.	Drywell Temperature (C205)
11.	✓	11.	Torus Water Temperature (C207)
12.	✓	12.	RHR Flow A Loop: (P001) B Loop: (P002)
13.	✓	13.	Recirc Loop Flow (A&B loops) A: (3DMA015) B: (3DMA018)
14.	✓	14.	Recirc Loop Temperature (A&B lines) A: (B034 and B035) B: (B036 and B037)
15.	✓	15.	Reactor Vessel Metal Temperatures TR 2-3-89 Panel 9-21 *Ⓐ
16.	✓	16.	Relief Valve Tailpipe Temperatures A-D: (W094, W095, W096, W097)
Other Parameters			
17.	_____	17.	_____
18.	_____	18.	_____
19.	_____	19.	_____

* Rx Vessel Instrumentation

A Logic:
LI-86 - (B044) RPV 86
LI-91B - (B045) RPV LEVEL 73's
LR-68B - (SPDB047) RPV LEVEL 68's
LI-57A - (SPDB041) RPV LEVEL RPS
LI-72B - (SPDB040) RPV LEVEL 72's

B. Logic:
LR-98 - (M071) Rx Wide Range
LI-91A - (B046)
LR-68A - (SPDB043)
LI-58B - (SPDB042)
LI-72A - (SPDB021)

** This computer point is in psia.

*Ⓐ Data obtained from ERFIS points S023 - S034 6/19/04

EVENT RECONSTRUCTION (Continued)

NOTE

All process computer EDITS are QA documents and must be returned to Reactor & Computer Engineering for filing or R/CE must be notified to generate a duplicate "original".

Attach a copy or a duplicate of process computer edits given below:

	Check if Included	Edit	
1.	✓	1.	Alarm Typer Output For Duplicate Report: a) SLA Key (SLAMNU) b) ALARM Report (ALR) follow on screen instructions
2.	✓	2.	BOP/NSS Post Trip Log
3.	✓	3.	SOE Log
4.	N/A	4.	Shutdown Turbine Log (Log doesn't exist)

EQUENCE OF EVENTS

Plant Evolutions Preceding Scram:

No specific evolutions were in progress. Turnover had just been completed and the AO's were commencing rounds.

Time:	Event Description:
See attached Control Room Logs.	

POST TRIP REPORT (Continued)

EVENT RECONSTRUCTION (Continued)

Time: Event Description:

See attached Control Room Log

(Attach Additional Sheets as Required)

PLANT RESPONSE

CAUSE OF CHANNEL TRIP	TRIP WITHIN TECH SPEC LIMITS (circle one)	TRIPPED CHANNELS (S)*			
		A1	A2	B1	B2
MANUAL SCRAM (Reason: taking Mode Switch to Shutdown)		✓	✓	✓	✓
IRM Hi Flux ≤120/125 INOP	YES NO UNKNOWN				
APRM Hi Flux (See OP 2132)	YES NO UNKNOWN				
Hi Flux ≤15% (Reduced)	YES NO UNKNOWN				
INOP	YES NO				
DOWNSCALE ≥2/125	YES NO UNKNOWN				
HI RPV PRESSURE ≤1055 PSIG	YES NO UNKNOWN				
HI DRYWELL PRESSURE ≤2.5 PSIG	YES NO UNKNOWN				
RPV LOW WATER LEVEL ≥127.0 INCHES	Ⓑ YES NO (UNKNOWN)	✓	✓	✓	✓
SDV HI LEVEL ≤21 GALLONS	Ⓐ YES NO (UNKNOWN)	✓	✓	✓	✓
MSIV CLOSURE ≤10% VALVE CLOSURE	On YES (NO) UNKNOWN				
TCV FAST CLOSURE FIRST IN	(YES) NO	✓	✓	✓	✓
TSV CLOSURE ≤10% VALVE CLOSURE	Ⓒ YES NO (UNKNOWN)	✓	✓	✓	✓

*Document all RPS tripped channels - indicate "First In" if known.

Ⓐ Unable to determine exact volume the SDV High Level scram occurred at. No means possible.

Ⓑ Unable to verified RPS level due to transient on DAS-C. RPS level flat-lined when DAS-C failed.

Ⓒ Unable to determine exact position of TSV when TSV Closure scram occurred. No means possible

POST TRIP REPORT (Continued)

SAFETY SYSTEMS
ACTUATIONS AND PERFORMANCE

PLANT RESPONSE (Continued)

SYSTEM	SYSTEM INITIATED	ACTUATION WITHIN TECH SPEC LIMITS (circle one)	SYSTEM TRIP	TRIP WITHIN SETPOINT LIMITS (circle one)
Core Spray	DW Press Hi RPV Lvl Lo-LO and RPV Press Lo Not Initiated ✓	A Loop YES NO UNKNOWN B Loop YES NO UNKNOWN	[redacted]	
LPCI	DW Press Hi RPV Lvl Lo-Lo and RPV Press Lo Not Initiated ✓	A Loop YES NO UNKNOWN B Loop YES NO UNKNOWN		
HPCI	DW Press Hi RPV Lvl Lo-Lo Not Initiated ✓	YES NO UNKNOWN	Lo Suction Press Exh. Press Hi Turb. Overspeed RPV Hi Lvl System Isolation Not Tripped	YES NO UNKNOWN
RCIC	RPV Lvl Lo-Lo Not Initiated ✓	YES NO UNKNOWN	Lo Suction Press Exh. Press Hi Turb. Overspeed Lube Oil Press Lo RPV Hi Level System Isolation Not Tripped	YES NO UNKNOWN
ADS	Hi DW Press and Lvl Lo-Lo RPV Lvl Lo-Lo for 8 min. Not Initiated ✓	YES NO UNKNOWN	[redacted]	

POST TRIP REPORT (Continued)

PCIS ACTUATION

PLANT RESPONSE (Continued)

PCIS GROUP	ISOLATION OCCURRED (circle one)	ISOLATION SIGNAL		TRIP WITHIN TECH SPEC LIMITS (circle one)
1	YES (NO) 1/2 Note: "Silent" 1 Group 1 received due to loss of Instrument AC.	RPV Lo Lo Lvl Hi Mn Stm Flow Hi Mn Stm Tunnel Temp Lo MSL Press Condenser Low Vacuum	— — — — —	YES NO (UNKNOWN) #7
2	(YES) NO	RPV Lo Lvl DW Press Hi	✓ —	YES NO (UNKNOWN) Ⓐ
3	(YES) NO	RPV Lo Lvl DW Press Hi Rx Bldg Hi/Lo Rad Refuel Flr Hi/Lo Rad	✓ — — —	YES NO (UNKNOWN) Ⓐ
4	YES (NO) previously isolated	RPV Lo Lvl DW Press Hi RPV Press Hi	— — —	YES NO UNKNOWN
5	(YES) NO	RPV Lo Lvl	✓	YES NO Ⓐ (UNKNOWN)
6	YES (NO)	Hi Stm Line Space Temp Hi Stm Line Flow Lo Stm Line Press Hi Mn Stm Tunnel Temp	— — — —	YES NO UNKNOWN

Ⓐ Unable to determine RPS/PCIS water level from ERFIS due to transient w/ DAS-C that occurred during scram. #7

PLANT RESPONSE (Continued)

System Responses:

1. Emergency Diesel Generators

Did not start. Not required

2. Turbine and Auxiliaries (include MHC performance)

Turbine tripped as required. EHC removed in service
Condenser used as heat sink during cooldown to
Cold Shutdown

3. CRD System

Operated normally, secured all CRD because of vessel
stratification concerns.

4. Reactor Protection System

NOTE

If the scram is accomplished by means other than the expected scram signal, the Power Transient Safety Limit (TS 1.1.c) shall be assumed to be exceeded and action required per TS Section 6.3 and TRM Section TRM 6.4 must be initiated.

RPS responded as expected. Expected scram (TCV Fast
Closure) occurred first

5. Feedwater System

Level decreased to 127", A and C pumps running, Placed "A" in PTL as level increased, "A" Feed Reg valve closed as expected, "B" locked up at approximate 100% valve. Close blocking valves and put remaining pumps in PTL. Restart Feedwater system when level started trending down

6. ECCS Systems (including RCIC)

No ECCS systems started manually or automatically. Received high level trips at 177".

7. Safety Valves or Relief Valves or Both

* No SVs or SRVs opened
* "A" and "C" acoustic monitors high alarms. (From electrical transient?)
CR-VTY-2004-2076 written

PLANT RESPONSE (Continued)

3. PCIS

Groups 2, 3, 5 due to level less than 127"
Silent group I

9. Radiological Response

Per Radiation Protection department no unusual or unexpected radiological responses occurred.

10. Chemistry Response

Notified chemistry of RWCU isolation. Informed of requirement to set up conductivity monitoring. No other abnormal results occurred.

PLANT RESPONSE (Continued)

11. AOG Rupture Disc Response (ER981421_03)

✓ Intact _____ Ruptured

12. Other Systems/Components or General Comments

① New ~~FTS-2000~~ NAS 2nr phone not used correctly. Operator failed to key phone. Notifications made using back-up method (CR-VTY-2004-2005)

② A & B Recirc Pumps tripped
-All 4 running recirc lube oil pumps tripped. Control power fuses blown (CR-~~20~~ 2nr VTY-2004-2010)

③ Grounds received on DC-1 and DC-2 (CR-VTY-2004-2008 and ~~200~~ 2nr 2039)

④ Instrument AC loss/swap (CR-VTY-2004-2009)
- "B" FWR value locked up
- Hogger suction value isolation

⑤ "C" Air Compressor tripped (CR-VTY-2004-2020)

⑥ Received Cable Vault Room 1st Detector Fire alarm w/ no visible smoke in the Cable Vault Room (CR-VTY-2004-2040)

⑦ Received the F-3 local alarms on the "A" & "B" EDG control panels. Alarms can in and cleared w/ no flags present (CR-VTY-2004-2038)

⑧ Torus-to-Drywell Vacuum breaker lights out on local panels. CR-VTY-2004-2023

⑨ Low Voltage Alarms for Buses 1, 2, 3, 4, 8 & 9 received. CR-VTY-2004-2055

SUMMARY

Probable cause of trip:

The cause of the trip was due to a Generator Load Reject. The Load Reject was the result of a failure in the 22 KV Isophase Bus system which resulted in a unit differential generator trip and a fire.

Unexpected aspect(s) of transient behavior: (Note any previous similar transient or UFSAR references.)

No unexpected aspects of the transient occurred. The UFSAR was reviewed (sect 14.5.1.1 and 14.5.5.3). The load reject scram was the expected scram and it was the scram that was received. Several previous Post Trip Reports were reviewed including 97-01, 97-03, 00-01 and 01-01. No discrepancies noted.

Recommendations to Prevent Recurrence:

See recommendations of Root Cause Analysis Report

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name:	LAWRENCE E. DOANE	Location at Time of Transient:	SHIFT MANAGER'S DESK
Department:	OPERATIONS	Contact:	802 258 5433
Assigned Position:	SM		Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient. NONE

   Describe anything unusual regarding environment or process in which you were involved.

   100 % NORMAL OPS - (GEN NEUTRAL GROUND IN FOR ~1 MINUTE AND CLEARED THE DAY BEFORE)

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls).

   ADG PANNALARM / HVAC TROUBLE? HEARD RELAY ACTUATIONS AND SYMPTOMS OF SCRAM. SCRAM LIGHTS ON - RODS INSERTING. VERIFIED ALL RODS IN. DIRECTED ENTRY INTO OT 3100. STA RESPONDED TO FIRE. ← SAS ANNOUNCED TO CONTROL ROOM THAT FLAMES ARE SHOWING AT THE MAIN TRANSFORMER

   NOTED VOLTAGE ON BUS 1, 2, 3, 4, 8, 9.

3. Describe any system/component malfunction that was observed from your location.

   RECIRC PUMP TRIP

   OTHER MALFUNCTIONS WERE REPORTED TO ME/CRS

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.

   - PRESTAGING OF CORE PROCEDURE FOR E PLAN (OP 3540) & AP 0152 FOR FOR E PLAN CLASSIFICATION
   - DE-ESCALATION FROM E-PLAN NEEDS REVISION FOR U.E.

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name:	Bryan Croke	Location at Time of Transient:	Control Room
Department:	Ops	Contact:	3070
Assigned Position:	CRS	Extension # / page	3070

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient. none

   Describe anything unusual regarding environment or process in which you were involved.

   Received AOG alarm & HVAC trouble alarm. Shortly after received scram recirc pump trip and fire alarms

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls).

   Rx scram, fire, recirc pump trip, group 2+3+5 isolations, FRV B lockup

3. Describe any system/component malfunction that was observed from your location.

   Lockup of B FRV, ARM alarms, rupture of 1A phase bus duct cooling high main transformer pressure Zone 37 fire alarm cable vault loss of inst ~~air~~ AC caused isolation of Logger suction values

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.

   More manpower EPLAN with fire rx scrams

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name: WAYNE MANNING

Location at Time of Transient: CONTROL ROOM

Department: ORS

Contact: 5438

Assigned Position: CRO (BOP)

Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient.

   Describe anything unusual regarding environment or process in which you were involved.

   WAS AT 9-50 PANEL, PLANT TRIPPED

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls).

   Rx SCRAM, TURB TRIP, OBSERVED MAIN XMFR HI PRESSURE TRIP, GEN, GROUND CURRENT HI.

3. Describe any system/component malfunction that was observed from your location.

   INST. AC LOSS TEMPORARILY.

   JOGS CYCLING (SUPPLY TO AC-DP1) AND CONTROL ROOM FIRE PANEL ALARMS CYCLING.

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.

   - INDICATIONS OF GENERATOR FAULT CAUSES.
   - EQUIPMENT LOSSES WITH BUS LOSSES (BUS B, INST. AC)

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name:	JIM SHEPHERD	Location at Time of Transient:	CRO - 9-5
Department:	OPERATION	Contact:	5439
Assigned Position:	CRO 9-5		Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient. NORMAL PLANT OPS, NO TESTING ~ 0640

   Describe anything unusual regarding environment or process in which you were involved.
   RECEIVED ADS AND HVAC ALARMS SIMULTANEOUSLY THEN TURB → Rx SCRAM,

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls).
   HVAC ALARMS/ ADS ALARM - TOGETHER
   SCRAM WITH TURBINE TRIP PB1 ON MASTER LEVEL
   TRIPPED A RFP AFTER LEVEL "127" RESTORATION
   "B" MFRV LOCKED-UP @ ~45.8
   RESET LOCKED-UP
   ISOLATED BLOCKING VALVES AFTER RFP OFF @ ~173"
   LEVEL STABILIZED AT 179" THEN TURNED
   RESTARTED "B" RFP WHEN LEVEL RETURNED
   USED AUX REG VALVE FOR LEVEL CONTROL

3. Describe any system/component malfunction that was observed from your location.
   "B" MFRV LOCKED (NORMAL FOR LOSS OF INST. AC) RESET PER 2172, RESET LOSS OF IA) SILENT EP1, HOGGER SUCTION ISOLATED
   LATER RECEIVED HI-HI ON "F" IRM COINCIDED WITH PLANT C/D USING 3POT
   02-19 "00" YELLOW/AMBER
   22-15 "00" YELLOW/AMBER
   JOCKEY STARTING / SEC ELECTRIC FIRE PUMP CYCLING NOW IN RUN

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.
   FCV-4 "MAN" ABNORMAL INDICATION
   B CU TRIP ON "127" RESTARTED, THEN TRIPPED AFTER SOME TIME

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name: Vince Ferrizzi

Location at Time of Transient: Control Room

Department: Operations

Contact: x 5333 / 452-6686

Assigned Position: ACRO - CRS U/I

Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient.

   Describe anything unusual regarding environment or process in which you were involved.
   ADG system alarm and a HVAC system trouble alarm energized at the same time.

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls). See comment #1
   I was going to investigate the HVAC Trouble. As I was walking past the 9-17 panel I heard the scram relays actuate.

3. Describe any system/component malfunction that was observed from your location.
   I saw the isophase ducting above the Main XFMR on fire from SAS early in the transient.

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.
   None

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name: Albert Zandler

Location at Time of Transient: Control Room

Department: OPS

Contact: 5270 / 452-6903

Assigned Position: SM (SRO) Trainee

Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient. None

   Describe anything unusual regarding environment or process in which you were involved.
   HVAC + AOG alarm just before plant trip.

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls). Rx Scram / Plant trip, Fire alarm/trouble Security office ask me to look @ his camera. It showed a small fire on top of MN transformer. I told SRO/SM, and made fire announcement. checked Security camera again fire was much larger. SM told me to walkdown panels + get alarms, After some time CRS needed Hogger Running he sent me into plant to perform procedure. After that was complete he sent me to get RWCU back,

3. Describe any system/component malfunction that was observed from your location.
   DC-1 ground in during fire.

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.
   None

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name: A T Wisniewski

Location at Time of Transient: C R

Department: Ops

Contact: x 5427

Assigned Position: STA

Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient.

   Describe anything unusual regarding environment or process in which you were involved.

   none

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls).

   - Load Reject Scram - PSRP all rods in
   - Security informed CR of fire on Main transformer
   - I left the CR to deal with fire

3. Describe any system/component malfunction that was observed from your location.

   - Damage to leads on Main Transformer

   3

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.

   My involvement was with leading the Fire Brigade

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name: TIMOTHY SHOWERS

Location at Time of Transient: GATEHOUSE 2 DESK

Department: OPS

Contact: 5191

Assigned Position: AO OUTSIDE WATCH

Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient.

   Describe anything unusual regarding environment or process in which you were involved.

   NOTHING OBSERVED

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls). AT APPROX, 0645 I WAS AT GATEHOUSE 2 GETTING KEYS FOR AO BLAZER FOR ROUNDS WHEN LIGHTS FLICKERED AND A BOOM WAS HEARD, I LOOKED OVER MY SHOULDER TO THE RIGHT AND SAW A BRIGHT FLASH ON TOP OF THE MAIN XFMER, I RETRIEVED MY BADGE AND HEADED TOWARDS THE BRIDGADE ROOM WHEN I REACHED THE DOOR TO THE SERVICE BUILDING THERE WAS FIRE ON TOP OF THE MAIN XFMER AND ANNOUNCEMENT MADE OF FIRE BY CONTROL ROOM. I THEN DRESSED OUT IN BUNKER GEAR AND COMMENCED FIGHTING FIRE.

3. Describe any system/component malfunction that was observed from your location.

   MAIN XFMER ISOPHASE BUS

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.

   NOTHING OBSERVED

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name:	Michael Flory	Location at Time of Transient:	Radwaste
Department:	OPS	Contact:	5191 / 452-6689
Assigned Position:	Radwaste AO		Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient.

   Describe anything unusual regarding environment or process in which you were involved.
   I was In Radwaste, Taking Rounds. The only evolution in Progress was Processing waste collector Tank Through The waste collector Filter / waste Demin to waste Sample Tank A.

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls).
   I heard a loud bang, then All the Lights went out. A few Seconds later the lights came back on; And All ~~the~~ Alarms on Both Radwaste And Fuel Pool Panels came in. I cleared the Alarms, then One of the guard radios reported A Fire so I reported TO The Fire Brigade Room.

3. Describe any system/component malfunction that was observed from your location.
   See #2

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.
   None

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name: Wayne Manning (U2)

Location at Time of Transient: Cable Vault

Department: Ops

Contact: 5191

Assigned Position: AO III (Turb Bldg)

Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient.

   Describe anything unusual regarding environment or process in which you were involved.

   On Rounds

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls).

   heard a loud bang, Noticed lights shift over, heard announcement for fire

3. Describe any system/component malfunction that was observed from your location.

   N/A

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.

   N/A

POST TRIP REPORT (Continued)

PRE/POST TRIP INFORMATION SUMMARY SHEET

Name: Vince Roll

Location at Time of Transient: AO's Room

Department: Ops.

Contact: 5121

Assigned Position: AO.

Extension # / page

1. List any system operations, maintenance or plant testing that was in progress at your location at the time of the transient.

   Describe anything unusual regarding environment or process in which you were involved.

   nothing

2. List the sequence of events as observed from your location (include a time sequence of any alarms received/discussions/Gaitronics responses/phone calls).

   AO's Room, Heard ~~[illegible]~~ Bang, then followed by Lights going out. Control Room Ann. Rx scram & then See, call Control Room with fire.

3. Describe any system/component malfunction that was observed from your location.

   Main Xfmr on fire.

4. Additional observations/comments which you feel would help in the analysis of this transient or prevention of future transients.

   n/A

Reactor & Computer Engineering notified of scram and requested to complete OP 4424, "Control Rod Scram Testing and Data Reduction"

DF May / DF May 16-18-04 / 0800
Date Time

Operations Training Manager notified of scram.

DF May / DF May 16-18-04 / 0715
Date Time

Initiate AP 0145, Equipment Cycle Record Keeping.

J. Twarog / 6/21/04 / 1320
Date Time

SCRAM with loss of normal heat removal (UND99051_01)

☐ Yes ☒ No

Ops Supt. 6/28/04 / 0930
Date Time

Reviewed By A. Wisniewski / 6/21/04 / 0857
Duty STA Date Time

Reviewed By LAWRENCE E. DONNÉ June 21, 2004 1630
Duty Shift Manager Date Time

Reviewed By Chris Wamser / 6/28/04 / 0930
Operations Manager Date Time

Reviewed By / /
PORC Secretary Date Time

Any subsequent findings or additional information, including Review Committee recommendations or PORC Review Minutes should be attached to the report for future reference.

POST TRIP REPORT (Continued)

REACTOR SCRAM/SHUTDOWN ACTION ITEMS

Scram/Shutdown Number _____ (to be assigned before filing)

Date 6/19/04 Time 12:30

Page 1 of ~~4~~ 5

ACTION ITEM NUMBER/WR NUMBER	DESCRIPTION	CR* Y/N	RESPONSIBLE SUPERVISOR	ACTION REQUIRED BY	ACTION COMPLETE DATE	WRITTEN FOLLOW-UP REQUIRED YES/NO	REMARKS
04-061969	Low flow alarm (7-D-8) received when "B" isophase duct cooling fan selected	Y	McKenney	Startup			CR-VTY-2004-2007
04-061978	Ground on DC-1 reading 88 VDC pos.	Y	Terras	Startup			CR-VTY-2004-2008
04-061979	Momentary loss of Instrument AC	Y	Vibert	Startup			CR-VTY-2004-2009
04-061980	Blown fuses on Recirc MG LO pumps P-77-1A/1B/1C/D	Y	Vibert	Startup			CR-VTY-2004-2010

*Include CR # if available.

LPC 1

Note: All Action Items have been identified as ~~Start~~ Startup Restraints in PCRS or assigned an "Action Required By" date

POST TRIP REPORT (Continued)

REACTOR SCRAM/SHUTDOWN ACTION ITEMS

Scram/Shutdown Number _____ (to be assigned before filing)

Date 6/19/04 Time 12:30

Page 2 of 5

ACTION ITEM NUMBER/WR NUMBER	DESCRIPTION	CR* Y/N	RESPONSIBLE SUPERVISOR	ACTION REQUIRED BY	ACTION COMPLETE DATE	WRITTEN FOLLOW-UP REQUIRED YES/NO	REMARKS
04-061981	High pressure trip on Main Transformer	Y	Nichols	Start-up			CR-VTY-2004-2011
(1)	Reactor Scram due to fire in ISO-Phase bus duct	Y	Wamser	Startup			CR-VTY-2004-2015
04-061977	JDDG power cycling between Normal and Emergency source ≈ every 3 minutes	Y	Terras	Startup			CR-VTY-2004-2007
(2)	"C" Air Compressor tripped after scram	Y	Vibert	startup	6/23/04	No	CR-VTY-2004-2020
(3)	Both Recirc Pumps tripped due to scram	Y	Vibert	Startup			CR-VTY-2004-2021

*Include CR # if available.

LPC 1

POST TRIP REPORT (Continued)

REACTOR SCRAM/SHUTDOWN ACTION ITEMS

Scram/Shutdown Number_____(to be assigned before filing)

Date 6/19/04 Time 12:30

Page 3 of ~~4~~ 5

ACTION ITEM NUMBER/WR NUMBER	DESCRIPTION	CR* Y/N	RESPONSIBLE SUPERVISOR	ACTION REQUIRED BY	ACTION COMPLETE DATE	WRITTEN FOLLOW-UP REQUIRED YES/NO	REMARKS
④	"B" FW Reg Valve locked up @ time of scram.	Y	Lefrancois	Startup			CR-VTY-2004-2024
⑤	Torus-to-Drywell Vac. Breakers indicating lights and alarms indicate valves may have cycled	Y	Vibert	Startup			CR-VTY-2004-2023
⑥	AOG recombiner and OG-516B isolated during scram	Y	Vibert	Startup			CR-VTY-2004-2025
⑦	H_2 fire on H_2 Seal Oil level detector	Y	Terras	Startup			CR-VTY-2004-2027

*Include CR # if available.

LPC 1

POST TRIP REPORT (Continued)

REACTOR SCRAM/SHUTDOWN ACTION ITEMS

Scram/Shutdown Number _____ (to be assigned before filing)

Date 6/19/04 Time 12:30

Page 4 of ~~4~~ 5

ACTION ITEM NUMBER/WR NUMBER	DESCRIPTION	CR* Y/N	RESPONSIBLE SUPERVISOR	ACTION REQUIRED BY	ACTION COMPLETE DATE	WRITTEN FOLLOW-UP REQUIRED YES/NO	REMARKS
04-061986	V67-7B has stripped threads	Y	McKenney	Startup			CR-VTY-2004-2028
04-061987	DCS-1 Trouble Alm(6-M-1) locked in	Y	Vibert	Startup			CR-VTY-2004-2029
(8)	81-1T indicated that it cycled twice during plant transrent	Y	Vibert	6/30/04	6/24/04		CR-VTY-2004-2037
(9)	Received alarm F-3 on both EDG panels	Y	Vibert	6/30/04			CR-VTY-2004-2038
(10)	Ground on DC-2	Y	Terras	6/30/04			CR-VTY-2004-2039
(11)	1st detector alarm on CW Room CO_2 system	Y	Boothroyd	7/19/04			CR-VTY-2004-2040

*Include CR # if available.

LPC 1

POST TRIP REPORT (Continued)

REACTOR SCRAM/SHUTDOWN ACTION ITEMS

Scram/Shutdown Number_____(to be assigned before filing)

Date_____ Time_____

Page 5 of 5

ACTION ITEM NUMBER/WR NUMBER	DESCRIPTION	CR* Y/N	RESPONSIBLE SUPERVISOR	ACTION REQUIRED BY	ACTION COMPLETE DATE	WRITTEN FOLLOW-UP REQUIRED YES/NO	REMARKS
(13)	"A" and "C" SV Acoustic monitor alarm	Y	Vibert	Startup			CR-VTY-2004-2076

*Include CR # if available.

LPC 1

POST TRIP REPORT (Continued)

REACTOR SCRAM/SHUTDOWN ACTION ITEMS

Scram/Shutdown Number_____(to be assigned before filing)

Date_____ Time_____

Page_____ of _____

ACTION ITEM NUMBER/WR NUMBER	DESCRIPTION	CR* Y/N	RESPONSIBLE SUPERVISOR	ACTION REQUIRED BY	ACTION COMPLETE DATE	WRITTEN FOLLOW-UP REQUIRED YES/NO	REMARKS

*Include CR # if available.

LPC 1

POST TRIP REPORT (Continued)

REACTOR SCRAM/SHUTDOWN ACTION ITEMS

Scram/Shutdown Number_____(to be assigned before filing)

Date_____ Time_____

Page_____ of _____

ACTION ITEM NUMBER/WR NUMBER	DESCRIPTION	CR* Y/N	RESPONSIBLE SUPERVISOR	ACTION REQUIRED BY	ACTION COMPLETE DATE	WRITTEN FOLLOW-UP REQUIRED YES/NO	REMARKS

*Include CR # if available.

LPC
1

Comments from crew interview, 6/18/04

Events (not necessarily in order)

- Received AOG and HVAC alarms (as was received previous morning when ground in)
- Neutral transformer ground annunciator/typer received
- During a similar event 24 hours earlier, agistat timer was heard running but stopped when alarms cleared.
- As operator proceeded to answer AOG alarms, Rx SCRAM occurred approximately 10 seconds after receiving AOG/HVAC alarms
- Both Main and Auxiliary transformer high pressure alarms/trips were received
- Both recirc pumps tripped
- Security guard (SAS) reported to operator that flames, he described as candling, were evident on top of transformer
- In approximately 4 minutes, flames went from "candling to approximately 20 feet high
- Fire alarms received included main/aux transformer, water flow immediately and cable vault first detector later in the event.
- Entered EOPs
- Feedwater blocking valves needed to be closed and remaining feedwater pumps secured (PTL) to stop level increase after "B" feed reg valve locked up at approximately 48% (full power position)
- Fast transfer occurred as expected
- RWCU lost
- As in previous SCRAMs, PSRP screen showed three "yes" indicating all rods in but other ERFIS indication showed two rods not yet all the way in. Operators verified ARI.
- When AOG lost (almost immediately) hogger started within 10-15 minutes
- HVAC alarms had been prevalent the last few days
- Initiated OP 2106 to deal with overflow of moats to river. Main transformer deluge secured just prior to applying foam. Aux. transformer deluge and water curtain secured later.
- Electric fire pump cycling on and off with diesel fire pump running constantly. Minimum flow valve would have prevented the cycling.
- All service water pumps running (standby pumps started)
- Cable vault and Switchgear CO_2 systems were put into abort after receiving 1st detector alarm in CV (smoke from transformer fire?)
- DC-1 and DC-2 grounds received
- Responding fire departments had no trouble getting into protected area
- Shift AOs reported to OCC and were assigned tasks from their
- Open line was maintained between Control Room and "TSC" (TSC not required for UE)

Challenges

- Loss of instrument AC
- Recirc pump trip
- FW reg valve lockup
- Manpower: all AOs to fire, E-Plan paperwork with STA gone
- Numerous issues associated with bus losses/electrical transients
- Confusion/lack of knowledge in attempt to notify states via NAS system

Improvements that could be made

- The process of searching for the correct procedure in the E-Plan Implementing Procedure book is cumbersome. Because the STA, who receives the most practice in the implementation of OP 3540, was gone, personnel less familiar with the process lost valuable time searching for the correct procedure and forms. It was strongly suggested that a third volume be created that contained only the procedure(s) and forms required to implement the initial time sensitive notifications.
- De-escalation from Unusual Event required TSC coordinator sign-off but TSC activation is not required for an Unusual Event. Procedure needs to be changed.
- There was no protocol to direct AOs on where to report when arriving subsequent to the event. Manpower was apparently available but unknown to supervisors/managers for a significant amount of time during the event.
- No AOs were available for normal duties associated with stabilizing the plant subsequent to the Rx SCRAM or other transient. Although the transformer fire was of sufficient magnitude to warrant utilizing all available AOs, discussions ensued on the lack of a mechanism that would enable a decision to be made on allocating AO resources. For instance, for a fire of lesser magnitude where four AOs were available, someone should be able to make a decision where the fourth AO should go, either to the fire or to the OCC/Control Room to help the Control room respond to the transient.

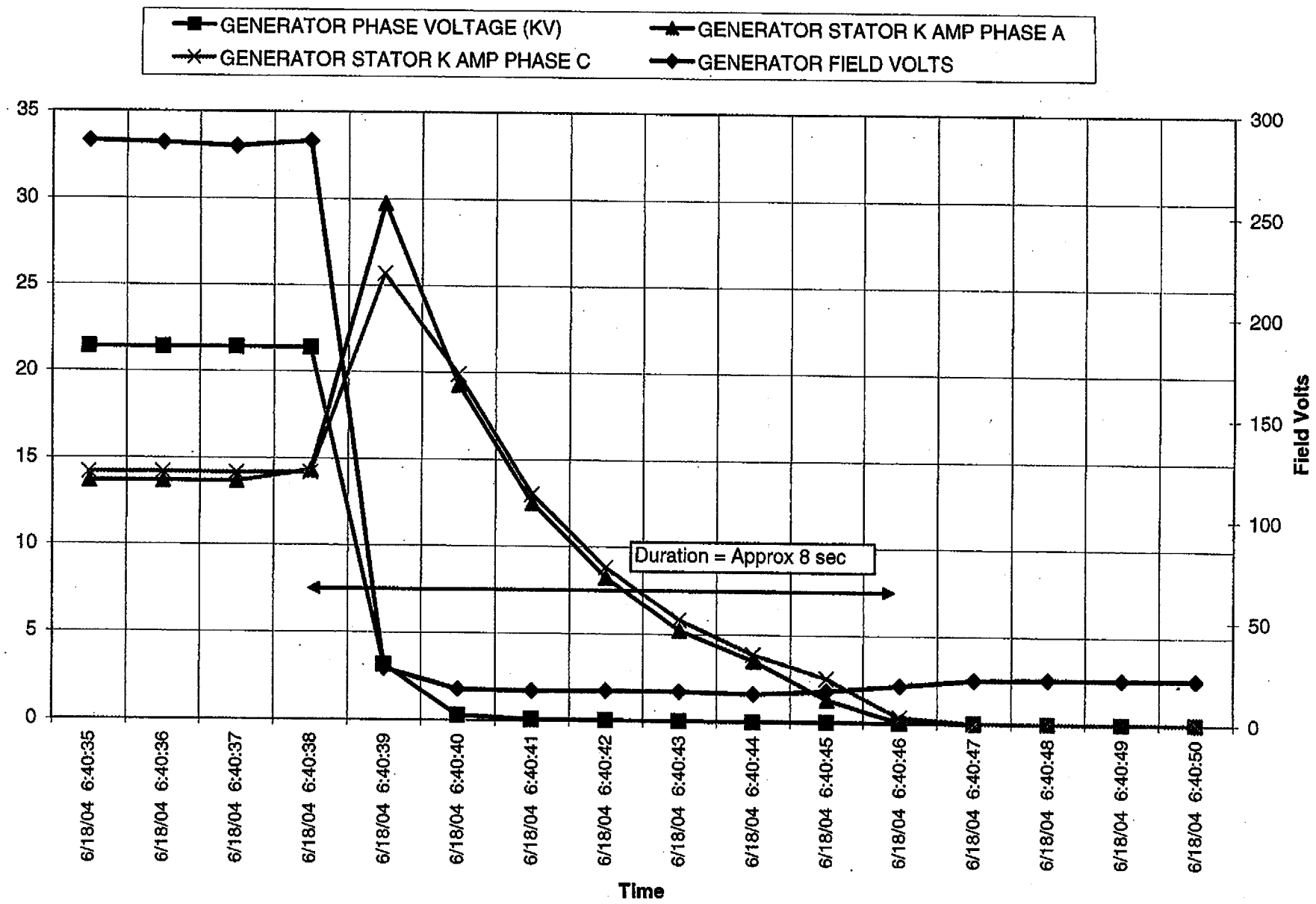
Preliminary

EVENT TIMELINE

Time in Milliseconds (Beckwith Timestamp Milliseconds)	Event	Comments
0 (4028)	The lightning/surge arrestor associated with the "A" Phase of the 22kV System breaks down and initiates a Phase-to-Ground Fault. [Note: There is minimal potential for an arcing fault at this location to propagate down the Isophase Duct since the subject compartment does not communicate with the ventilated portion of the bus duct.] "A" Phase-to-Ground Voltage shifts from approx. 12.4kV to 0 kV. "B" and "C" Phase-to-Ground Voltages shift from approx. 12.4kV to 21.5kV. [Note: Phase-to-Phase Voltages remain at 21.5kV.]	Ground fault current limited to approximately 5 Amps by the ground fault neutralizer circuit. Beckwith relay shows that Generator Neutral voltage is 180 degrees out of phase with the "A" phase. This confirms that the first ground fault was at the PT/Surge Cabinet.
102 (4130)	The insulation between the "B" Phase of the 22kV System and Ground breaks down and initiates the second ground fault. This establishes a short circuit path from "A" Phase-to-Ground-to-"B" Phase. The location of this second ground fault is at the Main Transformer Low Voltage Bushing Box. The "A" Phase lightning/surge arrestor catastrophically fails when current flow increases from 5 amps to 80,000 amps (i.e. 94,000 amps measured minus 14,000 amps of load current). This magnitude of current flow to ground is also experienced at the subject "B" Phase ground fault.	The Beckwith Generator Relay Data Acquisition System shows that "A" and "B" Generator Phase Amps increase to 650% of nominal. "C" Generator Phase current remains constant for the next 5 cycles. Over the next five cycles, "A" to "B" Phase currents shift from 120 degrees to 180 degrees out of phase (with respect to each other).
113 (4141)	The Instantaneous Element of the 87/GMT "B" Phase Relay actuates and trips the Main Generator Backup Lockout Relay.	The Differential Element for all three 87/GMT relays was tripped in addition to the "B" Phase Instantaneous Element. Based on discussion with Bill Mathis, the Instantaneous Element is the fastest of the two types and actuates within one cycle.

113-196 (4141-4224)	Over this 5 cycle period, 22kV voltage decreases to approximately 50% of nominal levels due to the "A" Phase-to-Ground-to "B" Phase fault. This event in-turn resulted in corresponding voltage dips in the 4kV system.	Within a few milliseconds of the fault, the Bus 1 and 2 Synch Check Relays indicate a loss of synchronism between the Aux and Startup Transformers.
196 (4224)	The following breakers trip within a few milliseconds of each other to de-energize the 22kV system: • Generator Field Breaker • Aux Transformer Breaker 12 • Aux Transformer Breaker 22 • Generator Breaker 1T • Generator Breaker 81-1T	The opening of the 81-1T and 1T breakers terminates the fault current contribution from the Main Transformer. Essentially, the Main Transformer was only exposed to fault current for approximately 5 to 6 cycles. From this point on, the fault is only supplied from the decaying Main Generator Stator/Field.
197 (4225)	Main Generator "C" Phase current drops from nominal levels to approximately zero due to isolation of the generator from the 345kV and 4kV systems. The fault between the "A" and "B" Phases continues.	
247 (4275)	The Main Generator Primary Lockout Relay Trips due to actuation of the Main Transformer Fault Pressure Relay. No additional equipment actuations occur since the Primary and Backup Lockout relays perform the same functions.	Based on satisfactory testing and oil analysis of the Main Transformer, it is concluded that the Fault Pressure Relay was spuriously triggered by a pressure pulsation within the Low Voltage Bushing Box (as opposed to arcing within the Transformer).
425 (4453)	Startup Transformer Breaker 23 Closes to re-energize Bus 2. It is believed that the "B" Recirc Pump Recirc MG Lube Oil control power fuses blew at this point.	ERFIS Data indicates that the Aux to Startup Transfer of Bus 2 from the Aux to the Startup Transformers occurred in approximately 14 cycles. Previous 4kV Bus "Fast Transfers" have been recorded at 4 to 5 cycles. This delayed transfer is attributed to the loss of synchronism between the two sources when the 22kV system faults occurred.

478 (4506)	Startup Transformer Breaker 13 Closes to re-energize Bus 1. It is believed that the "A" Recirc Pump Recirc MG Lube Oil control power fuses blew at this point.	ERFIS Data indicates that the Aux to Startup Transfer of Bus 1 from the Aux to the Startup Transformers occurred in approximately 17 cycles. Previous 4kV Bus "Fast Transfers" have been recorded at 4 to 5 cycles. This delayed transfer is attributed to the loss of synchronism between the two sources when the 22kV system faults occurred.
572 (4600)	Arcing/Ionization at the "B" Phase of the Main Transformer Low Voltage Bushing Box carries to the "C" Phase and initiates a fault at this location. [Note: It is unknown whether this fault is a Phase-to-Phase or Phase-to-Ground fault.]	At this point, the fault appears to be relatively balanced between all three phases. Phase A, B, and C currents are now approximately 120 degrees out of phase with respect to each other.
Approx. 8000	ERFIS Data indicates that Main Generator Stator currents have decayed to approx. zero.	


GENERATOR PHASE VOLTAGE (KV)
GENERATOR STATOR K AMP PHASE A
GENERATOR STATOR K AMP PHASE C
GENERATOR FIELD VOLTS
35
30
25
20
15
10
5
0
300
250
200
150
100
50
0
Field Volts
Duration = Approx 8 sec
6/18/04 6:40:35
6/18/04 6:40:36
6/18/04 6:40:37
6/18/04 6:40:38
6/18/04 6:40:39
6/18/04 6:40:40
6/18/04 6:40:41
6/18/04 6:40:42
6/18/04 6:40:43
6/18/04 6:40:44
6/18/04 6:40:45
6/18/04 6:40:46
6/18/04 6:40:47
6/18/04 6:40:48
6/18/04 6:40:49
6/18/04 6:40:50
Time

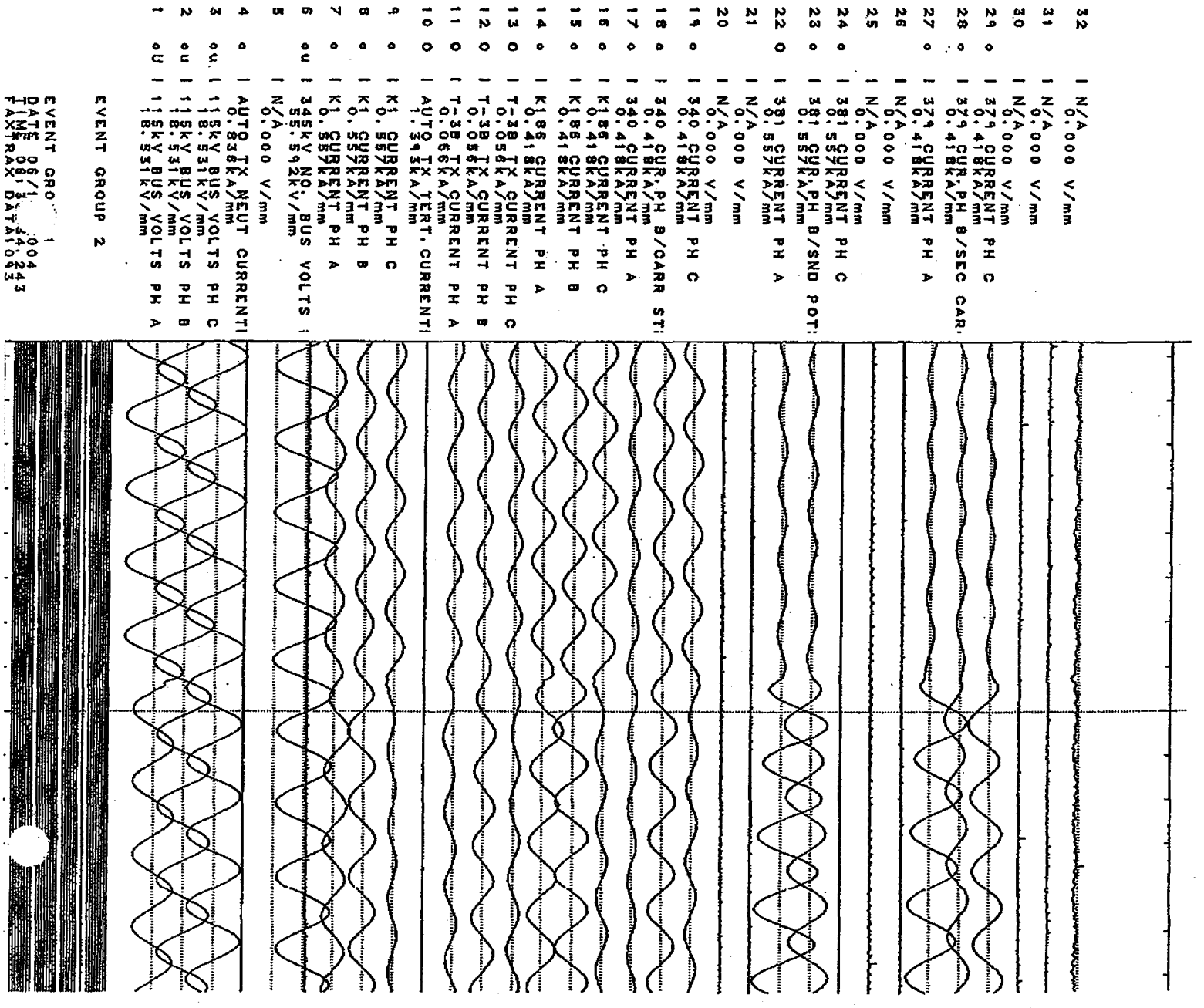
VERMONT YANKEE SUBSTATION
DIGITAL FAULT RECORDER
Attention:Engineering Department

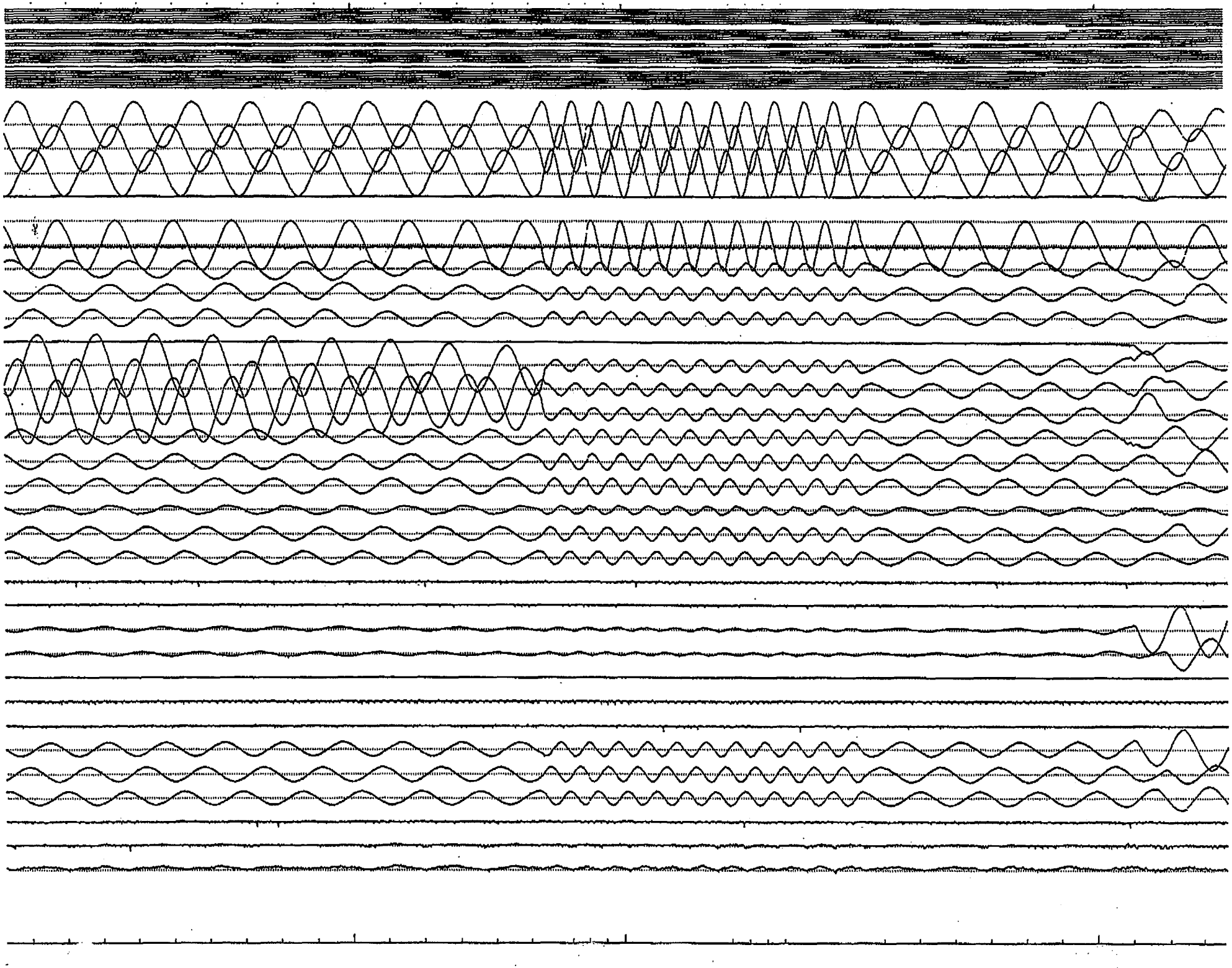
JUNE 18, 2004 RTC TIME 06:38:34.243 RECORD NUMBER 1093

RECORDER DATA SUMMARY

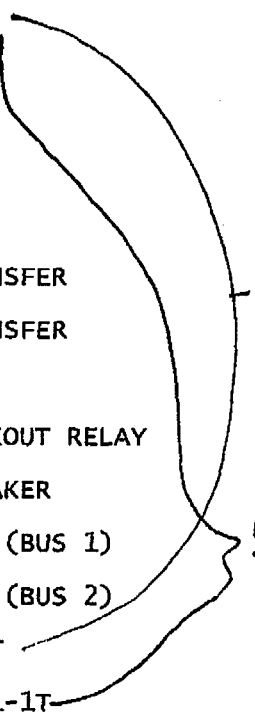
		CHANNEL NAME	TYPE	VALUE	START	DURATION	RMS(.5-1.5cy)
	27	379 CURRENT PH A	OVER	2.845kA	34.243	0.007	1.404kA
	22	381 CURRENT PH A	OVER	4.628kA	34.243	0.008	2.332kA
	1	115kV BUS VOLTS PH A	UNDER	66.64kV	34.254	0.083	
	22	381 CURRENT PH A	OVER	4.628kA	34.260	0.072	2.332kA
	27	379 CURRENT PH A	OVER	2.845kA	34.260	0.030	1.404kA
EVENT	14	ATB 81-1T BKR POSIT	ALARM	——	34.324	0.000	——
	10	AUTO TX TERT.CURRENT	OVER	3.574kA	34.325	0.020	
EVENT	9	K186 CARRIER ON	ALARM	——	34.350	0.048	——
EVENT	8	1T BKR POSITION	ALARM	——	34.351	0.000	——
EVENT	9	K186 CARRIER ON	RTN	——	34.398	——	——
EVENT	9	K186 CARRIER ON	ALARM	——	34.424	0.026	——
EVENT	9	K186 CARRIER ON	RTN	——	34.450	——	——
	11	T-3B TX CURRENT PH A	OVER	0.372kA	34.589	0.007	
	13	T-3B TX CURRENT PH C	OVER	0.573kA	34.590	0.010	
	12	T-3B TX CURRENT PH B	OVER	0.504kA	34.594	0.008	
	11	T-3B TX CURRENT PH A	OVER	0.372kA	34.606	0.409	
	13	T-3B TX CURRENT PH C	OVER	0.573kA	34.607	0.009	
	12	T-3B TX CURRENT PH B	OVER	0.504kA	34.610	0.418	
	13	T-3B TX CURRENT PH C	OVER	0.573kA	34.624	0.402	

4.86 cycles
81ms
108ms
(6.48 cycles)





18-JUN-04	06:40:38	ARP	06:40:38	E517	SERV WATER PMP B MOTOR BREAKER			CLOSE	OK 0
18-JUN-04	06:40:38	ARP	06:40:38	B030	REACTOR FEEDWATER INLET TEMP A1	367.42	DEG F	OK	OK
18-JUN-04	06:40:38	ARP	06:40:38	B032	REACTOR FEEDWATER INLET TEMP B1	299.37	DEG F	OK	OK
18-JUN-04	06:40:38	ARP	06:40:38	E007	4KV BUS 4 KV	3.5948	KV	LO	U
18-JUN-04	06:40:38	ARP	06:40:38	E015	480 VOLT BUS 8 VOLTAGE	394.07	VAC	LO	U
18-JUN-04	06:40:38	ARP	06:40:38	E526	STATOR COOLING MOTOR A BREAKER			OPEN	U 1
18-JUN-04	06:40:38	ARP	06:40:38	M500	TURBINE BUILDING FAN A			OFF	U 1
18-JUN-04	06:40:38	ARP	06:40:38	M501	TURBINE BUILDING FAN B			ON	OK 0
18-JUN-04	06:40:38	ARP	06:40:38	M502	REACTOR BUILDING FAN A			OFF	U 1
18-JUN-04	06:40:38	ARP	06:40:38	M506	SERVICE BUILDING FAN A			OFF	U 1
18-JUN-04	06:40:38	SEP	06:40:38.247	D580	GEN TRIP-UNIT DIFF			TRIP	U 1
18-JUN-04	06:40:38	SEP	06:40:38.191	M560	RRU MOTOR 1A			OFF	OK 0
18-JUN-04	06:40:38	SEP	06:40:38.193	M562	RRU MOTOR 2A			OFF	OK 0
18-JUN-04	06:40:38	SEP	06:40:38.195	M576	RRU MOTOR 4A			OFF	OK 0
18-JUN-04	06:40:38	SEP	06:40:38.200	M574	RRU MOTOR 3A			OFF	OK 0
18-JUN-04	06:40:39	SEP	06:40:38.249	D619	BUS 1/T3A SYNCH TRANSFER			LOSS	U 0
18-JUN-04	06:40:39	SEP	06:40:38.250	D620	BUS 2/T3B SYNCH TRANSFER			LOSS	U 0
18-JUN-04	06:40:39	SEP	06:40:38.270	D580	GEN TRIP-UNIT DIFF			NORM	OK 0
18-JUN-04	06:40:39	SEP	06:40:38.287	D588	GEN TRIP-BACKUP LOCKOUT RELAY			TRIP	U 1
18-JUN-04	06:40:39	SEP	06:40:38.291	D598	GENERATOR FIELD BREAKER			OPEN	U 1
18-JUN-04	06:40:39	SEP	06:40:38.295	D591	AUX XFMR BREAKER 12 (BUS 1)			OPEN	U 1
18-JUN-04	06:40:39	SEP	06:40:38.295	D592	AUX XFMR BREAKER 22 (BUS 2)			OPEN	U 1
18-JUN-04	06:40:39	SEP	06:40:38.296	D597	GENERATOR BREAKER 1T			OPEN	U 1
18-JUN-04	06:40:39	SEP	06:40:38.299	D596	GENERATOR BREAKER 81-1T			OPEN	U 1



18-JUN-04	06:40:39 SEP	06:40:38.301	D596	GENERATOR BREAKER 81-1T	CLOSE	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.302	D596	GENERATOR BREAKER 81-1T	OPEN	U	1
18-JUN-04	06:40:39 SEP	06:40:38.304	D596	GENERATOR BREAKER 81-1T	CLOSE	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.304	D596	GENERATOR BREAKER 81-1T	OPEN	U	1
18-JUN-04	06:40:39 SEP	06:40:38.317	D583	GEN TRIP-MAIN XFMR PRESSURE	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.334	D605	TURB TRIP-VACUUM TRIP #1	TRIP	U	0
18-JUN-04	06:40:39 SEP	06:40:38.371	D534	REACTOR AUTO SCRAM A	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.374	D561	REACTOR AUTO SCRAM B	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.381	D623	GEN TRIP-PRIMARY LOCKOUT RELAY	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.393	D541	GEN LOAD REJ SCRAM C	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.395	D541	GEN LOAD REJ SCRAM C	NORM	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.396	D539	GEN LOAD REJ SCRAM A	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.399	D542	GEN LOAD REJ SCRAM D	TRIP	U	1
18-JUN-04	06:40:39 ARP	06:40:38 M508		GENERATOR ON LINE	OFF	U	0
18-JUN-04	06:40:39 SEP	06:40:38.400	D542	GEN LOAD REJ SCRAM D	NORM	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.401	D542	GEN LOAD REJ SCRAM D	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.401	D541	GEN LOAD REJ SCRAM C	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.401	D539	GEN LOAD REJ SCRAM A	NORM	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.403	D542	GEN LOAD REJ SCRAM D	NORM	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.405	D539	GEN LOAD REJ SCRAM A	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.408	D540	GEN LOAD REJ SCRAM B	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.413	D542	GEN LOAD REJ SCRAM D	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.414	D539	GEN LOAD REJ SCRAM A	NORM	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.428	D539	GEN LOAD REJ SCRAM A	TRIP	U	1

18-JUN-04	06:40:39 SEP	06:40:38.278	M561	RRU MOTOR 1B	OFF	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.278	E540	UPS-2A TRIP	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.286	M536	ISOLATION GROUP 2 A LOGIC	ISOL	U	0
18-JUN-04	06:40:39 SEP	06:40:38.290	M536	ISOLATION GROUP 2 A LOGIC	NORM	OK	1
18-JUN-04	06:40:39 SEP	06:40:38.291	M536	ISOLATION GROUP 2 A LOGIC	ISOL	U	0
18-JUN-04	06:40:39 SEP	06:40:38.325	M535	ISOLATION GROUP 1 INBOARD	ISOL	U	0
18-JUN-04	06:40:39 SEP	06:40:38.484	D537	TSV 3 OR 4 CLOSURE SCRAM	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.489	D599	STEAM BYPASS VALVE ODD	OPEN	U	0
18-JUN-04	06:40:39 SEP	06:40:38.497	D535	TSV 1 OR 2 CLOSURE SCRAM	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.500	D538	TSV 2 OR 4 CLOSURE SCRAM	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.506	D536	TSV 1 OR 3 CLOSURE SCRAM	TRIP	U	1
18-JUN-04	06:40:39 SEP	06:40:38.510	D600	STEAM BYPASS VALVE EVEN	OPEN	U	0
18-JUN-04	06:40:39 SEP	06:40:38.518	D603	TURBINE STOP VALVE 3	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.524	D594	STARTUP XFMR BREAKER 23 (BUS 2) 229ms	CLOSE	U	0
18-JUN-04	06:40:39 SEP	06:40:38.538	D601	TURBINE STOP VALVE 1	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.538	D601	TURBINE STOP VALVE 1	OPEN	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.542	D601	TURBINE STOP VALVE 1	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.542	D601	TURBINE STOP VALVE 1	OPEN	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.558	D604	TURBINE STOP VALVE 4	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.563	D601	TURBINE STOP VALVE 1	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.565	D604	TURBINE STOP VALVE 4	OPEN	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.566	D604	TURBINE STOP VALVE 4	CLOSE	U	1
18-JUN-04	06:40:39 SEP	06:40:38.570	D601	TURBINE STOP VALVE 1	OPEN	OK	0
18-JUN-04	06:40:39 SEP	06:40:38.572	D601	TURBINE STOP VALVE 1	CLOSE	U	1

18-JUN-04 06:40:39 SEP	06:40:38.573	D601	TURBINE STOP VALVE 1		OPEN	OK	0
18-JUN-04 06:40:39 SEP	06:40:38.577	D601	TURBINE STOP VALVE 1		CLOSE	U	1
18-JUN-04 06:40:39 SEP	06:40:38.577	D593	STARTUP XFMR BREAKER 13 (BUS 1) 282ms		CLOSE	U	0
18-JUN-04 06:40:39 SEP	06:40:38.595	D602	TURBINE STOP VALVE 2		CLOSE	U	1
18-JUN-04 06:40:39 SEP	06:40:38.753	D620	BUS 2/T3B SYNCH TRANSFER		NORM	OK	1
18-JUN-04 06:40:39 SEP	06:40:38.803	D619	BUS 1/T3A SYNCH TRANSFER		NORM	OK	1
18-JUN-04 06:40:39 ARP	06:40:39	M532	PC AIR SAMPLE 109-76A POSITION		CLOSE	U	0
18-JUN-04 06:40:39 ARP	06:40:39	M548	SCRAM SOLENOID GROUP 1 RPSA		SCRAM	U	0
18-JUN-04 06:40:39 ARP	06:40:39	M549	SCRAM SOLENOID GROUP 1 RPSB		SCRAM	U	0
18-JUN-04 06:40:39 ARP	06:40:39	M550	SCRAM SOLENOID GROUP 3 RPSA		SCRAM	U	0
18-JUN-04 06:40:39 BOP BOPTRIP - BOP/NSS TRIP LOG TRIGGERED							
18-JUN-04 06:40:39 ARC ARCPST - A BOP/NSS TRIP WAS DETECTED, ARCHIVING DATA							
18-JUN-04 06:40:39 ARP	06:40:39	M551	SCRAM SOLENOID GROUP 3 RPSB		SCRAM	U	0
18-JUN-04 06:40:39 ARP	06:40:39	B030	REACTOR FEEDWATER INLET TEMP A1	376.95	DEG F	HI	U
18-JUN-04 06:40:39 ARP	06:40:39	E004	4KV BUS 1 KV	3.2210	KV	LO	U
18-JUN-04 06:40:39 ARP	06:40:39	E005	4KV BUS 2 KV	3.3971	KV	LO	U
18-JUN-04 06:40:39 ARP	06:40:39	F009	RX FEED PUMP DISCH HDR PRESS	1134.4	PSIG	LO	U
18-JUN-04 06:40:39 ARP	06:40:39	E006	4KV BUS 3 KV	3.2322	KV	LO	U
18-JUN-04 06:40:39 ARP	06:40:39	T039	TURBINE SPEED	1859.2	RPM	HI	U
18-JUN-04 06:40:39 ARP	06:40:39	E018	480 VOLT BUS 9 VOLTAGE	402.15	VAC	LO	U
18-JUN-04 06:40:39 ARP	06:40:39	G038	GROUND FAULT NEUTRAL VOLTAGE	15.106	VOLT	HI	U
18-JUN-04 06:40:39 ARP	06:40:39	T010	HIGH PRESS TURBINE EXHAUST PRESS	201.60	PSIG	HI	U
18-JUN-04 06:40:39 ARP	06:40:39	M552	SCRAM SOLENOID GROUP 2 RPSA		SCRAM	U	0
18-JUN-04 06:40:39 ARP	06:40:39	M553	SCRAM SOLENOID GROUP 2 RPSB		SCRAM	U	0

COPY

345 KV RELAY TARGET CHECK SHEET

	Circle As-Found Condition (Normal Condition is Underlined)		
PANEL 6F, NORTHFIELD 345KV LINE GENERATOR #1			
345KV MOS 1T-22 Position Lamps	Green		RED
Control Switch	Red Flag		No Flag
345KV MOS 1T-11 Position Lamps	Green		Red
Control Switch	Red Flag		No Flag
381 (ATB 4) Primary Trip Lamp			Red
381 (ATB 4) Breaker Status Lamps	Green	White	Red
381 (ATB 4) Control Switch	Red Flag		Flag
381 (ATB 4) Transfer Switch	Local		Remote
381 (ATB 4) Recloser Switch	Inst	Off	Sync. Ck
81-1T (ATB 1) Primary Trip Lamp			Red
81-1T (ATB 1) Breaker Status Lamps	Green	White	Red
81-1T (ATB 1) Control Switch	Red Flag		Flag
81-1T (ATB 1) Transfer Switch	Local		Remote
81-1T (ATB 1) Recloser Switch	Inst	Off	Sync. Ck
1T (ATB 5) Primary Trip Lamp			Red
1T (ATB 5) Breaker Status Lamps	Green	White	Red
1T (ATB 5) Control Switch	Red Flag		Flag
1T (ATB 5) Transfer Switch	Local		Remote
1T (ATB 5) Recloser Switch	Inst	Off	Sync. Ck
Relays:			
381 (ATB 4) Sync. Check	No Target		Target
381 (ATB 4) Instantaneous Overcurrent	No Targets		Target A,B,C
81-1T (ATB 1) Sync. Check	No Target		Target
81-1T (ATB 1) Instantaneous Overcurrent	No Targets	003	Target A,B,C
1T (ATB 5) Sync. Check	No Target		Target
1T (ATB 5) Instantaneous Overcurrent	No Targets		Target A,B,C
PANEL 7F, NORTHFIELD 345KV LINE GENERATOR #1			
POR Receiver:			
Indicator Lamps			
Yellow (Trip)	Not Lit		Lit
Red (Guard)	Lit		Not Lit
TSR Control Switch	Test	Off	Norm
TSS Control Switch	Trip	Off	Norm

345 KV RELAY TARGET CHECK SHEET (Continued)

PANEL 7F, NORTHFIELD 345KV LINE GENERATOR #1 (Cont.)	Circle As-Found Condition (Normal Condition is Underlined)
Breaker Fail Channel #1:	
Meter Indication	2.15 milliamperes
Indication Lamps	
Yellow (Trip)	Not Lit / Lit
Red (Guard)	Lit / Not Lit
TSR-1 Control Switch	Test / Norm / Off
TSS Ch. 3/4 Xmtr Test	Ch. 3 Norm Off / Off Ch. 4
Breaker Fail Channel #2:	
Meter Indication	1.2 milliamperes
Indication Lamps	
Yellow (Trip)	Not Lit / Lit
Red (Guard)	Lit / Not Lit
TSR-2 Control Switch	Norm / Off / Test
Breaker Fail Trip from Northfield	
White Lamp	Lit / Not Lit
Lockout Relay	No Flag / Flag
345KV MOS 381-3 Position Lamps:	
Green (Open)	Not Lit / Lit
Red (Closed)	Lit / Not Lit
Control Switch	Red Flag / No Flag
Transfer Switch	Remote / Local
345KV MOS 1T Position Lamps:	
Green (Open)	Not Lit / Lit
Red (Closed)	Lit / Not Lit
Control Switch	Red Flag / No Flag
Transfer Switch	Remote / Local
Relays:	
381 Perm TT (Top-labeled 94A-381 Line)	No Target / Target
381 TT (Top-Labeled 94BFI-381 Line)	No Target / Target
381 TT (Bottom-labeled 94BF2-381 Line)	No Target / Target

345 KV RELAY TARGET CHECK SHEET (Continued)

PANEL 8F, 345KV LINE 379

379 (ATB 3) Primary Trip Lamp
379 (ATB 3) Breaker Status Lamps
379 (ATB 3) Control Switch
379 (ATB 3) Transfer Switch
379 (ATB 3) Reclose Switch

79-40 (ATB 2) Primary Trip Lamp
79-40 (ATB 2) Breaker Status Lamps
79-40 (ATB 2) Control Switch
79-40 (ATB 2) Transfer Switch
79-40 (ATB 2) Recloser Switch

Relays:

379 (ATB 3) Sync. Check
379 (ATB 3) Instantaneous Overcurrent
79-40 (ATB 2) Sync. Check
79-40 (ATB 2) Instantaneous Overcurrent

PANEL 9F, 345KV LINE 379

Indicator Lamp:

White (Primary or Secondary Carrier On)

Circle As-Found Condition (Normal Condition is Underlined)		
Green	White	Red
Red Flag		Red
Local		No Flag
Inst	Off	Remote
		Sync. Ck
Green	White	Red
Red Flag		Red
Local		No Flag
Inst	Off	Remote
		Sync. Ck
No Target		Target
No Targets		Target A,B,C
No Target		Target
No Targets	005	Target A,B,C
Not Lit	005	Lit

345 KV RELAY TARGET CHECK SHEET (Continued)

	Circle As-Found Condition (Normal Condition is Underlined)		
PANEL 9F, 345KV LINE 379			
Secondary Carrier:			
Meter Indication	005		DC microamperes
Indicator Lamps			
White (Channel Alarm)	Not Lit	005	Lit
Sec. Carrier Control (CCS) Switch	(On)		Off
Sec. Carrier Test (CTS) Switch	RS	Rec (Norm)	Send
345KV MOS 379-3 Position Lamps:	Green		(Red)
Transfer Switch	Local		(Remote)
Relays:			
379 TT (Top)	(No Target)		Target
379 TT (Bottom)	(No Target)		Target
379 Line Carrier Receiver	(No Target)		Target
PANEL 10F, COOLIDGE LINE			
Transfer Trip Receiver #1:			
Amber Trip Lamp	(Not Lit)		Lit
Red Guard Lamp	(Lit)		Not Lit
TSR-1 Switch	(Norm)	Off	Test
TSS Switch	Test 3	(Norm) Off	Test 4
Transfer Trip Receiver #2:			
Meter Reading	71		DC microamperes
Amber Trip Lamp	(Not Lit)		Lit
Red Guard Lamp	(Lit)		Not Lit
TSR-2 Switch	(Norm)	Off	Test
Breaker Fail Trip from Coolidge:			
White Lamp	(Lit)		Not Lit
Lockout Relay	(No Flag)		Flag
345KV MOS 340-3 Position Lamps:			
Green (Open)	(Not Lit)		Lit
Red (Closed)	(Lit)		Not Lit
Transfer Switch	(Remote)		Local

345 KV RELAY TARGET CHECK SHEET (Continued)

	Circle As-Found Condition (Normal Condition is Underlined)	
PANEL 10F, COOLIDGE LINE (Cont.)		
Relays:		
Coolidge 1T TT Aux Receiver Ch I	No Target	Target
Coolidge 1T Bolted Fault	No Targets	Target A,B,C
Coolidge 1T TT Aux Receiver Ch II	No Target	Target
BATTERY CHARGERS 4A AND 4A-5A	4A	4A-5A
AC Input Indicating Light	Lit Not Lit	Lit Not Lit
Battery Voltmeter (Normal: ~130 volts)	_____DC Volts	_____DC Volts
Battery Ammeter (Normal: ~10 amps)	_____DC Amps	_____DC Amps
High Voltage Light (DC)	Lit Not Lit	Lit Not Lit
Low Voltage Light (DC)	Lit Not Lit	Lit Not Lit
Charger Failure Indicating Light	Lit Not Lit	Lit Not Lit
AC Input Breaker	On Tripped Off	On Tripped Off
DC Feed Bkr to DC-4A	On Tripped Off	On Tripped Off
DC Feed Bkr to DC-5A		On Tripped Off
4A Alarm Bypass Switch	Normal or Bypass	
4A-5A Alarm Bypass Switch	Normal or Bypass	
CAB 9, 340 LINE		
TSR Lights	Trip Guard	None
TSR Switch	Test Off	Norm
TSS Switch	Send Off	Norm
Primary Relay Cut-off	Test Off	Norm
System Failure Alarm	Lit	Not Lit
OPTIMHO Relay Digital Display Reads (VY 340 Line)	Lit	Not Lit
Red Light (Trip)	Lit	Not Lit
Yellow Light (Alarm)	Lit	Not Lit
Green Light (Relay Available)	Lit	Not Lit
CAB 8, 379 LINE PRIMARY RELAYS CARRIER		
Relay Targets:		
T1	No Target	Target
T2	No Target	Target
T3	No Target	Target
T4	No Target	Target
CCS Switch	On	Chan Off
CTS Switch	Test Rec Norm	Send
Channel Alarm White Light	On	Off
CAB 7, NORTHFIELD PRIMARY RELAYS CARRIER		
Relay Targets:		
T1	No Target	Target
T2	No Target	Target
T3	No Target	Target
T4	No Target	Target

	Circle As-Found Condition (Normal Condition is Underlined)
CAB 7, NORTHFIELD PRIMARY RELAYS CARRIER (Cont.)	
Relay Targets (Cont.):	
CCS Switch	(On)
CTS Switch	Test Rec (Norm)
Channel Alarm White Light	On (Off)
	Chan Off
	Off
PANEL 10R, COOLIDGE 345 LINE SECONDARY RELAYS	
Relays:	
340 Directional Zone 1	Target (No Target)
340 Directional Zone 2	Target (No Target)
340 Carrier Start	Target (No Target)
340 Directional Ground Carrier Start	Target (No Target)
340 Directional Ground	
Time	Target (No Target)
Inst.	Target (No Target)
340 Directional Distance Fault	Target (No Target)
340 Receiver Relay	Target (No Target)
Meter	005 DC microamps
White Light	Lit (Not Lit)
CCS Switch	(On) Off
CTS Switch	RS Rec (Norm) Send
PANEL 9R, 345KV LINE 379 BREAKER FAILURE RELAYS	
379 ATB #3 Failure:	
Light	(Lit) Not Lit
Left Lockout	(No Flag) Flag
Right Lockout	(No Flag) Flag
79-40 ATB #2 Failure:	
Light	(Lit) Not Lit
Left Lockout	(No Flag) Flag
Right Lockout	(No Flag) Flag

345 KV RELAY TARGET CHECK SHEET (Continued)

	Circle As-Found Condition (Normal Condition is Underlined)	
PANEL 8R, 345KV LINE 379 SECONDARY RELAYS		
379 Line Zone 1 Distance	No Target	Target
379 Line Zone 2 Distance	No Target	Target
379 Line Fault Detect	No Target	Target
379 Line Zone 2 Timer	No Target	Target
379 Line Directional Distance Phase A	No Target	Target
379 Line Directional Distance Phase B	No Target	Target
379 Line Directional Distance Phase C	No Target	Target
379 Line Distance Gnd Timer Phase	No Targets	Target A,B,C
379 Line Phase Carrier Start	No Target	Target
379 Line Carrier Dir Gnd	No Target	Target
379 Line Bolted Fault	No Targets	Target A,B,C
PANEL 7R, NORTHFIELD 345KV LINE BREAKER FAILURE RELAYS		
381 ATB #4 Failure:		
White Light	Lit	Not Lit
Left Lockout	No Flag	Flag
Right Lockout	No Flag	Flag
81-1T ATB #1 Failure:		
White Light	Lit	Not Lit
Left Lockout	No Flag	Flag
Right Lockout	No Flag	Flag
1T ATB #5 Failure:		
White Light	Lit	Not Lit
Left Lockout	No Flag	Flag
Right Lockout	No Flag	Flag
PANEL 6R, NORTHFIELD 345KV SECONDARY RELAYS		
Relays:		
Northfield 381 Zone 1 Distance	No Target	Target
Northfield 381 Zone 2 Distance	No Target	Target
Northfield 381 Fault Detect	No Target	Target
Northfield 381 Zone 2 Timer	No Target	Target
Northfield 381 Directional Distance Phase A	No Target	Target
Northfield 381 Directional Distance Phase B	No Target	Target
Northfield 381 Directional Distance Phase C	No Target	Target
Northfield 381 Distance Gnd Timer Phase	No Targets	Target A,B,C
Northfield 381 Bolted Fault Phase	No Targets	Target A,B,C

	Circle As-Found Condition (Normal Condition is Underlined)		
PANEL 5R, 115KV SECONDARY BREAKER FAILURE - 345KV NORTH BUS			
Relays:			
North Bus Differential Phase A	No Target		Target
North Bus Differential Phase B	No Target		Target
North Bus Differential Phase C	No Target		Target
North Bus Diff Cutout Switch	Test	Off	On
345KV North Bus Differential:			
White Light	Lit		Not Lit
Left Lockout	No Flag		Flag
Right Lockout	No Flag		Flag
Relays:			
345KV Tie Line Bus Differential Phase A	No Target		Target
345KV Tie Line Bus Differential Phase B	No Target		Target
345KV Tie Line Bus Differential Phase C	No Target		Target
Tie Line Bus Diff Cutout Switch	Test	Off	On
345KV Tie Line Differential:			
White Light	Lit		Not Lit
Left Lockout	No Flag		Flag
Right Lockout	No Flag		Flag
115KV Secondary Breaker Failure			
White Light	Lit		Not Lit
Left Lockout	No Flag		Flag
Right Lockout	No Flag		Flag
PANEL 1R, SECONDARY BREAKER 345/115KV AUTO TRANSFORMER			
Relays:			
Autotransformer Differential Phase A			
Autotransformer Differential Phase B	No Target		Target
Autotransformer Differential Phase C	No Target		Target
Autotransformer Neutral Ground	No Target		Target
FP 1	No Target		Target
Autotrans A Ph OL	No Target		Target
Autotrans B Ph OL	No Target		Target
Autotrans C Ph OL	No Target		Target
Autotrans Grd	No Target		Target
	No Target		Target

PANEL 1R, SECONDARY BREAKER 345/115KV AUTO TRANSFORMER (Cont.)

	Circle As-Found Condition (Normal Condition is Underlined)	
Bus Differential CO Switch	Test	Off **On**
Trans Differential CO Switch	Test	Off **On**
Trans Differential CO Switch	Test	Off **On**
Lockouts:		
115KV Bus Diff	**No Flag**	Flag
White Light	**Lit**	Not Lit
Auto Xmfr Diff Primary	**No Flag**	Flag
White Light	**Lit**	Not Lit
Auto Xmfr Diff Secondary	**No Flag**	Flag
White Light	**Lit**	Not Lit
SU Xmfr Diff	**No Flag**	Flag
White Light	**Lit**	Not Lit
Relays:		
115KV Differential Phase A	**No Target**	Target
115KV Differential Phase B	**No Target**	Target
115KV Differential Phase C	**No Target**	Target
Auto Xmfr BU Differential Phase A	**No Target**	Target
Auto Xmfr BU Differential Phase B	**No Target**	Target
Auto Xmfr BU Differential Phase C	**No Target**	Target
FP 2	**No Target**	Target

BATTERY CHARGERS BC-5A-A AND BC-5A-B (for inservice charger)

	Charger A	Charger B
Volts (Normal ~135 VDC)		
Amps (Normal ~ 14 DC amps)		
AC On Lamp	Off **On**	Off **On**
High AC Volts	**Off** On	**Off** On
Low AC Volts	**Off** On	**Off** On
Gnd Det +	**Off** On	**Off** On
Gnd Det -	**Off** On	**Off** On
High DC Volts	**Off** On	**Off** On
Low DC Volts	**Off** On	**Off** On
Charger Failure	**Off** On	**Off** On
Charger Shutdown	**Off** On	**Off** On
Alarm Normal Bypass Switch Position	**Off** On	**Off** On
	Normal Bypass[1]	Normal Bypass[1]

Note [1]Switch in Bypass on standby (secured charger); in Normal for charger in service.

345 KV RELAY TARGET CHECK SHEET (Continued)

CAB 10, 379 LINE

Circle As-Found Condition (Normal Condition is Underlined)				
		From Amherst		
	Channel A		Channel B	
Trip	Lit **(Not Lit)**		Lit **(Not Lit)**	
Guard	**(Lit)** Not Lit		**(Lit)** Not Lit	
Chan. Fail	Lit **(Not Lit)**		Lit **(Not Lit)**	
		From Amherst		
	Channel A		Channel B	
43TSR-AM/ TTP-379 Switch	Off	By-Pass2	**Nor** (RTP)	By-Pass1	Off
30-AM/ TTP-379 Relay	Target			**(No Target)**	
43 TSS/ TTP-379 Switch	Test1	**(Norm)**	Off	Test2	

Remarks:

1. Record any relays or target drops that will not reset.

Recorded By J Tripp _____ 6/18/04
Operator (Print/Sign) Date

Reviewed By Ken Oliver / KOliver 6/22/04
Shift Manager (Print/Sign) Date

VERMONT ELECTRIC POWER COMPANY, INC.

SWITCHING ORDERS

ALL SWITCHING ORDERS MUST BE WRITTEN DOWN AND READ BACK AS RECEIVED. REFER TO THESE ORDERS WHILE SWITCHING.
CHECK (✓) EACH STEP WHEN COMPLETED.

STATION: ____________ COORDINATOR: ____________

ORDER NUMBER: ____________ DATE: __/__/__ TIME: ____________

STEP	SWITCHING ORDER			✓
1				
2				
3				
4				
5				
6				
7				
8	Charger shut down OFF	OFF	OFF	
9	Alarm Bypass Norm	Bypass	Norm	
10	GND Det - off	GND Det - off	GND - off	
11	GND Det + off	GND Det + off	GND + off	
12	DC BKR ON	DC out off	DC out ON	
13	AC BKR on	AC INPUT off	AC in on	
14	Charg fail off	Charg fail off	Charg fail off	
15	Lo Volt off AC&DC	Low Volt off	Low Volt off	
16	Hi Volt off AC+DC	Hi Volt off	Hi Volt off	
17	6 Amps	DC Amp 0	11 Amp	
18	130 Volts	DC volt 0	130 volt	
19	AC ON LIT	AC off	AC on	
20	BC - 4A	BC - 5A - 4A	5C - 5A	

SWITCHING PERFORMED BY: ____________ TIME COMPLETED: ____________
(SIGNATURE)

S.O. FORM / RUTLAND PRINTING 802/775-1948 11/03

115/345KV GUARD LIGHT SURVEILLANCE

Frequency: Weekly Other: _____ WO #: _____ Date: 6/18/04

Panel	Description	Indication	Initials
LPC4 2F K-186	Breaker Fail. Receive (Chestnut Hill)	Lit	
	Trans. Fail. Receive (Vernon Rd)	Lit	
7F Northfield	P.O.R. Receiver	Lit	
	Breaker Fail. Channel-1	Lit	
LPC7	Breaker Fail. Channel-2	Lit	
10F Coolidge	Transfer Trip Receiver No. 1	Lit	
	Transfer Trip Receiver No. 2	Lit	
CAB 9 Vermont Yankee to Coolidge			
	Test Switch Receive TSR-POTT/VY-C	Lit	
	Ga and Gb (LEDs on receiver behind door)	Lit	
CAB 2 Coolidge	Breaker Fail. (behind door)		
	Ga and Gb (LEDs on Receiver 1)	Lit	
LPC6 Cabinet 10 379 Line (Stand Alone Cabinet on East Wall)			
	From Amherst		
	43TSR-AM/TTP-379 Channel A	Lit	
	43TSR-AM/TTP-379 Channel B	Lit	

LPC7
Acceptance Criteria:

LPC 6+7 1. All guard lights illuminate.

Remarks:

Ken Olivier
Reviewed By: KOlivier 6/22/04
Shift Supervisor Date

VERMONT ELECTRIC POWER COMPANY, INC.

SWITCHING ORDERS

ALL SWITCHING ORDERS MUST BE WRITTEN DOWN AND READ BACK AS RECEIVED. REFER TO THESE ORDERS WHILE SWITCHING.
CHECK (✓) EACH STEP WHEN COMPLETED.

STATION: _____ COORDINATOR: _____

ORDER NUMBER: _____ DATE: 1 1 TIME: _____

STEP	SWITCHING ORDER	✓
1	CRP 9-22 Indicators	
2	① Gen-Main XFMR Differential 'A' 87/G-MT (A) Left flag	
3	② Gen-Main XFMR Differential 'B' 87/G-MT(B) Left and Right flag	
4	③ Gen-Main XFMR Differential 'C' 87/G-MT(C) Left flag	
5	④ Generator Multifunction Relay	
6	1. Target	
7	2. Diag	
	3. 59N/59X Neut/GND overvolt (initially in on 6/17/04)	
9	4. Output # 1, 3, 6	
10	⑤ Generator Primary Lockout 86/G-P	
11	⑥ Generator Backup Lockout 86/G-B	
12	CRP-9-8 Alarms	
13	① 8-A-1 "BKR 81-1T Trip" } Electric plant responded as expected during the generator Lockout	
14	① 8-B-1 "BKR 1T Trip" }	
15	③ 8-N-2 "DC-1-GND"	
16	④ 8-P-2 "DC-2-GND"	
17		
18		
20	Taken by USF	

WITCHING PERFORMED BY: _____ TIME COMPLETED: _____
(SIGNATURE)

OPERATOR'S LOG

DATE		POWER LEVEL
6-16-04	1800 - 0000	100%

1730 DJ STANDING SM U/I WATCH

6-17-04	0000 - 0600	100%

0010 Completed Weekly Task Performance Listing

[signature] / [signature]

6-17-04	0600 - 1800	100%

0535 VSF Standing CRS U/I Watch
0540 AG2 Standing SM U/I Watch
0600 GVB STANDING U/I WATCH AT TAGGING DESK
0655 Received 9-7-4-2 (GEN GND CURRENT Hi). Typer shows ground reading ~138 V for 1 minute. Ground returned to ~2.9 V. No activities in area of gen neutral ground.
0705 Reset target on generator multifunction relay panel. Alarm 9-7-4-2 cleared, neutral ground oversolt on multifunction panel remains. Steve Gunnip and Bob Swanson assisting. Ops management notified.
0740 Reset Generator Ground 59/N target. Attempted to reset multifunction panel alarm but was unsuccessful.
0750 Informed by S. Gunnip that the alarm on the Main Gen Beckwith relay will not clear until voltage drops to 0 volts. The alarm LED is for indication only and is not inputting to the generator L/O ckt.
1255 Transferred feedwater level control to Single-Element to troubleshoot feed/steam indicator spiking.

UNCONTROLLED COPY

OPERATOR'S LOG

DATE: 6-18-04 | 0600 - 0800 | POWER LEVEL: 100%

0530 VSF standing CRS U/I & AGZ standing SM U/I

0640 Reactor Scram (Gen Lockout) and Report of Flames
— * Smoking From Main Transformer

0641 RFP's A & C Tripped on High Level Due to 'B' FW
— Lock-up. Reset Lockup & Established Level 127"-177"
— With Condensate & Feed (B Cond Pp & B RFP)

0641+ STA & Fire Brigade Responding To Main X Former Fire

0646 Main X Former Deluge Valve Actuation

0650 Declared UE Due To U-4-a, An Unplanned *
— On-Site Fire Not Extinguished In 10 Minutes

0652 Fire Brigade On Scene.

0653 Maintaining Rate of Rx 800-1000psig With MFC

0705 Vernon Fire Dept On Site

0715 Foam Being Applied To Main Transformer

0717 Flames No Longer Showing At Main Transformer

0730 Evacuated Turbine Building Due To Smoke & Acrid
— Smell.

Late 0711 Initiated Notification Of NH, VT, & MA

Late 0642 Mode Selector Switch Placed In Shutdown

0732 Report Of Oil/Foam In River Near Intake. Entered
— OP-2106

0745 Placed Main Condenser Vacuum Pp In Service

0810 Placed East & West SWGR Room CO_2 Systems In
— Abort Due To Transient Smoke In The Rooms.
— Established Once Per Hour Fire Watch

0815 0810 Shut V-Yard-10 Per OP 2106 To Isolate Foam
— Oil Discharge

0830 Declared Main Transformer Fire Extinguished

0838 Secured 'B' Circ Water Pump

0855 Returned Security Loads To Bus-11. Secured 1DD6
— Per The Procedure By Pulling Cont. Pwr Fuses Due
— To Apparent Transfer Switch Malfunction

UNCONTROLLED COPY

OPERATOR'S LOG

04-114

DATE

06/18/04

POWER LEVEL

C

0600-1800 (continued)

5

1040 Cable vault and switchgear CO_2 systems returned to service

1445 WEM relieved GJR for BOP

1450 JPS Relieved ADZ as CRO

1500 LED Relieved KRO as SM, BC relieved THM as CRS

1538 Re-established the ring bus. Closed 81-1T and 1T.

1539 HPCI and RCIC STM Supply Lo Press Byp. switches placed in Warmup.

1550 NOTIFIED SSS OF JD06 INOPERABILITY

1653 Received low pressure SDC permissive alarm 91 psi.

LATE ENTRY DECLARED A & B TORUS/DRYWELL POSITION INDICATION OPERABLE FOLLOWING RESET ON LOCAL PANELS. ALL LIGHTS RE-ENERGIZED. INDICATION WAS LOST AND TECH SPEC 3.7.A.8 ENTERED AT 0650 WHEN INST AC WAS TEMPORARILY LOST

Bryan Choka

1800-0600

6/18/04

S/D

1919 STARTED "A" RHRSW for SDC

2030 PERFORMED FLUSH TO RADWASTE FROM RHR A LOOP — RADWASTE RECEIVED 6600 GALS

2035 DECLARED PRIMARY CONTAINMENT INOP with a 24 HR LCO DUE TO MANUAL VALVES OPEN for SDC OPERATIONS

2055 DECLARED "B" LPCI INOP FOR A 7 DAY LCO PER TS 3.7.A.4 FOR LOOP FLUSH

2103 EXITED TS 3.7.A.4, "B" LPCI OPERABLE

2118 DECLARED PRIMARY CONTAINMENT OPERABLE AFTER MANUAL RHR VALVES SHUT

2145 Established "A" RHR LOOP IN SDC W/ LEVEL 7185"

TECH. SPEC./TECHNICAL REQUIREMENTS MANUAL SYSTEMS/COMPONENTS INOPERABLE

SYSTEM/COMPONENT	TECH. SPEC./TRM PARAGRAPH	DATE/TIME DECLARED INOPERABLE	UNPLANNED LCO*	OPERATIONS REQUIRED LOGGING, TESTING OR OTHER ACTION (ER970390_03)	ALLOWABLE TIME INOPERATIVE	DATE/TIME DECLARED OPERABLE	SM/CRS INITIALS	
							INOP	OP
Rod Block Channel A	TRM 3.2.5	6/10/04 1305	No		Indef	6/10/04 1307	DJD	DJD
APRM C+F	TS Table 3.1.1	6/10/04 1309	No		Indef	6/10/04 1317	DJD	DJD
Rod Block Channel B	TRM 3.2.5	6/10/04 1308	No		Indef	6/10/04 1317	DJD	DJD
V12-28A P-49-1A	4.6.E.2	5/2/04 0900	N/A	~~A Raven Pump Tagged~~ Am	Indef		WK	
'B' SBGT	3.7.B.3.a	~~B~~ 6/12/04 2100	YES	'A' OPERABLE	7 DAY	6/13/04 0000	TS	TS
'B' LPCI	3.5.A.4	6/13/04 1108	NO		7 Day	6/13/04 1609	JF/Am	Am
CONTAINMENT CAM	3.6.C.2	6/13/04 2230	NO	DW Sumps Operable	7 DAY	6/13/04 2321	TS/SAB	TS/SAB
Containment CAM	3.6.C.2	6/14/04 0143	NO	SUMPS OPERABLE	7 DAY	6/14/04 0223	TS/SAB	TS/SAB
Drywell/Torus D/P Inst.	3.2.H.2	6/14/04 0718	NO		6 hr	6/14/04 0815	Am/pre	Am/Pre
RM-17-156 (Shield Gas I)	ODCM Table 3.1.2	6/14/04 1005	NO	Verify Shield Gas II Operable	~~30 Day~~ Indef	6/14/04 1135	Am/Pre	Am/Pre
'A' LPCI	3.5.A.4	6/15/04 0635	NO	Verify 'B' LPCI, cont. clg. 'A' and 'B' CS operable	7 Day	6/15/04 1615	Am/Pre	Am/Pre
Rx Bldg Inner RR Door	3.7.C	6/15/04 0940	NO	Verify outer door shut; pressurized	Indef	6/15/04 1108	Am/Pre	Am/Pre
Rx Bldg Outer RR Door	3.7.C	6/15/04 1108	NO	Verify inner door shut; pressurized	Indef	6/16/04 1157	Am/Pre	Am/Pre
RM-17-156 (Shield Gas I)	ODCM 3.1.2	6/15/04 1247	NO	Verify Shield Gas II Operable	~~30 Day~~ Indef	6/15/04 1300	Am/Pre	Am/Pre
RM-17-157 (Shield Gas II)	ODCM Table 3.1.2	6/15/04 1300	NO	Verify Shield Gas I Operable	Indef.	6/15/04 1312	Am/Pre	Am/Pre
TI 116-19-38C	TS Table 3.2.6	6/16/04 0721	NO		30 Day	6/16/04 0824	Am/JG	Am/JG
SR-VG-6A & 6B	TS Table 3.2.6	6/16/04 ~~0810~~ 0910	NO		7 Day	6/16/04 0921	Am/JG	Am/JG
ACD 116-101 (Control Room Door)	TRM 3.13.E.2	6/16/04 1447	YES	Continuous fire watch	Indef.	6/16/04 1505	Am/Pre	Am/Pre
A LPCI	TS 3.5.A.4	6/17/04 2330	NO	VERIFY B LPCI A+B CS + B CONT SPRAY	7 DAY	6/18/04 0013	RFS	RFS
Cable Vault CO_2	TRM 3.13.D.2	6-18-04 0805	YES	1 hour fire watch established	1 hour	6/18/04 ~~1240~~ 1205	BM	THM
Screw CO_2	TRM 3.13.D.2	6-18-04 0810	YES	1 hour fire watch establish	1 hour	6/18/04 1240	BM	THM
Qual Delayed off Site Power Source	3.10.B.3.a	6-18-04 0840	~~Yes~~ YES		7 days or fix before critical		BM	

TECH. SPEC./TECHNICAL REQUIREMENTS MANUAL SYSTEMS/COMPONENTS INOPERABLE

SYSTEM/COMPONENT	TECH. SPEC./TRM PARAGRAPH	DATE/TIME DECLARED INOPERABLE	UNPLANNED LCO*	OPERATIONS REQUIRED LOGGING, TESTING OR OTHER ACTION (ER970390_03)	ALLOWABLE TIME INOPERATIVE	DATE/TIME DECLARED OPERABLE	SM/CRS INITIALS	
							INOP	OP
A & B TDAFW/DW PUMP IND STEAM	3.7.A.8	6/18/04 0000	YES	24 Hour COLD S/D LCO	24 hours	6/18/04 * 1200	[illegible]	[illegible]
~~A & B PRIMARY CONT MANUAL VALVES~~	3.7.A.8	6/18/04 2035	NO	<212°F W/I 24 HRS	24 HRS	6/18/04 2035	NF	NF
B LPCI	3.7.A.4	6/18/04 2055	NO		7 DAY	6/18/04 2103	NF	NF
HCU Accumulator 38-27	3.3.D	6/19/04 1655	Yes		Indef		[illegible]	
"A" RHRSW PUMP	3.5.C.2	6/20/04 2145	YES		INDEF <212°		NF	
'A' EDG	3.10.A.1	6/21/04 1150	NO		INDEF			

* PANEL INDICATION RESET AT 1200 ON 6/18/04

VERMONT YANKEE NUCLEAR POWER STATION

OPERATING PROCEDURE

OP 3540

REVISION 4

CONTROL ROOM ACTIONS DURING AN EMERGENCY

USE CLASSIFICATION: **REFERENCE**

RESPONSIBLE PROCEDURE OWNER: **Manager, Training & Development**

REQUIRED REVIEWS		Yes/No
E-Plan	10CFR50.54(q)	Yes
Security	10CFR50.54(p)	No
Probable Risk Analysis (PRA)		No
Reactivity Management		No

LPC No.	Effective Date	Affected Pages
1	05/06/04	VYOPF 3540.06 Pg 1 of 2
2	06/10/04	VYOPF 3540.06 Pg 1 of 2

Implementation Statement: N/A

Issue Date: 04/28/04

TABLE OF CONTENTS

PURPOSE

This procedure outlines the basic emergency plan requirements and actions to be followed by the Control Room personnel in an emergency.

DISCUSSION

There are four emergency classifications, Unusual Event, Alert, Site Area Emergency, and General Emergency. The decision to make an immediate initial declaration rests with the Shift Manager/Plant Emergency Director, who, in turn, instructs Control Room personnel to activate the notification system. Notification of State authorities must be initiated within 15 minutes after the event has been classified. The NRC must be notified immediately after the States' notification, but not later than one (1) hour after the event has been classified.

An Unusual Event is defined as any plant-related event which indicates a potential degradation of plant safety margins which is not likely to affect personnel on-site or the public off-site or result in radioactive releases requiring off-site monitoring. Unusual Event conditions will not have caused serious damage to the plant and may not require a change in operation status.

The basic shift complement is able to deal with Unusual Event conditions. On-duty personnel are assigned to functions as required. Additional members of the plant organization, including top management, are notified by Plant Security, and augment on-duty personnel as necessary. The Duty On Call Officer who is available on an on-call basis must report to the site and will assume the role of the TSC Coordinator. Dissemination of public information and closure or escalation to a more severe classification will occur as conditions warrant.

An Alert event is defined as an indication of a substantial degradation of plant safety margins which could affect on-site personnel safety, could require off-site impact assessment, but is not likely to require off-site protective action.

An Alert event requires action beyond the normal capability of the basic shift complement. Plant response and off-site notification associated with this event classification ensure that sufficient emergency response personnel are mobilized to activate the Technical Support Center and the Operations Support Center. The Emergency Operations Facility/Recovery Center is activated with the Site Recovery Manager, the EOF Coordinator and other EOF/RC staff members. Sufficient emergency assistance personnel to assess off-site radiological impact are assigned if the Alert event is producing releases off-site. Actual releases of radioactivity which substantially exceed Technical Specification limits may be involved and thus radiation monitoring and dose projection may be an integral portion of the emergency response required. Prompt notification is made to State authorities and follow-up information is provided as needed to off-site emergency organizations.

A Site Area Emergency indicates an event which involves likely or actual major failures of plant functions needed for the protection of the public. The possibility does exist for some releases of radioactive material and response to this event emphasizes the ability to monitor the releases and to provide action recommendations to State authorities and follow-up information as needed to off-site emergency organizations.

Plant resources are anticipated to be sufficient to cope with a Site Area Emergency. Outside resources, however, are mobilized and selected members are dispatched to the site. All emergency centers are activated following declaration of a Site Area Emergency. All non-essential personnel are evacuated from the site. Representatives from adjoining States are dispatched to the Emergency Operations Facility. Assessment of plant conditions and off-site radiological parameters determine the type of protective measures necessary for protection of the public sector. The public is notified of the event by local media facilities and periodic updates of information are released to ensure uniform, adequate response to real conditions.

A General Emergency is declared when substantial core degradation or melting has occurred, with a potential for loss of containment integrity. The possibility does exist for releases of radioactive material and response to this event emphasizes the ability to monitor the releases and to provide for protective action recommendations to State authorities.

Contracted service organizations, sponsor utilities, and other industry resources are alerted and requested to render assistance as appropriate. In addition, Federal resources are called upon for assistance. Assessment of plant conditions and off-site radiological parameters determine the type of protective action recommendations.

Plant representatives closeout or escalate the emergency classification, or move to recovery as conditions warrant. Written summaries of the event are provided to off-site authorities and other affected agencies.

Upon declaration of an emergency classification, the Control Room becomes an Emergency Response Facility and the Shift Manager assumes the duties of the Plant Emergency Director (PED).

During the initial stages of an emergency, the PED will direct all phases of the emergency response. Actions will include:

- Classifying an emergency
- Notifying appropriate State authorities
- Notifying the NRC
- Initiating on-site habitability surveys, if necessary
- Formulating on-site personnel response recommendations, if necessary
- Performing initial off-site dose assessment, if necessary
- Initiating corrective actions required to restore normal operation, if necessary

As personnel respond to other Emergency Response Facilities, emergency functions will be transferred to the Technical Support Center Coordinator (TSCC) or the Site Recovery Manager (SRM) as appropriate.

Emergency Classification and PAR Notification Form (VYOPF 3540.06) specifies the contents and formal States notifications of emergency classifications and protective action recommendations (PARs) by Vermont Yankee, and is used by the Control Room in the authorization and transmittal of these notifications. Prior to the SRM assuming responsibility for the emergency response, the TSC Coordinator can authorize escalations and PARs, but the Control Room retains transmittal responsibilities to off-site agencies.

In the event that a Control Room evacuation and plant shutdown using alternate methods are required, Appendix A will be used to initially notify the States and the NRC of the declared emergency.

In accordance with AP 6002, Preparing 50.59 Evaluations, the results of an Applicability Determination (AD) has determined that an AD is not required for future changes provided the procedure scope is not changed. The basis for this conclusion is that this document is an Emergency Implementing Procedure and is subject to 10CFR50.54(q) to determine if the changes decrease the effectiveness of the Emergency Plan and if they have the potential to affect our ability to meet the standards of 10CFR50.47(b) and the requirements of 10CFR50 Appendix E.

ATTACHMENTS

1.	Appendix A	States and NRC Emergency Notification for a Control Room Evacuation Event
2.	VYOPF 3540.01	UNUSUAL EVENT IMMEDIATELY TERMINATED Announcement
3.	VYOPF 3540.02	UNUSUAL EVENT Announcement
4.	VYOPF 3540.03	ALERT Announcement
5.	VYOPF 3540.04	SITE AREA EMERGENCY Announcement
6.	VYOPF 3540.05	GENERAL EMERGENCY Announcement
7.	VYOPF 3540.06	Emergency Classification and PAR Notification/Upgrade Form
8.	VYOPF 3540.07	States Notification for a Control Room Evacuation

QA REQUIREMENTS CROSS REFERENCE

1. None

REFERENCES AND COMMITMENTS

1. Technical Specifications and Site Documents

   a. Vermont Yankee Nuclear Power Station Emergency Plan

2. Codes, Standards and Regulations

   a. None

3. Commitments

   a. UND-98012_01

4. Supplemental References

   a. ENN-OM-105, Fitness for Duty Program
   b. AP 0009, Condition Reports
   c. AP 0010, Situational Reporting Requirements
   d. AP 0021, Work Orders
   e. AP 0032, Duty On Call Officers and Emergency Plan Teams
   f. AP 0156, Notification of Significant Events
   g. AP 3125, Emergency Plan Classification and Action Level Scheme
   h. OP 3132, Operations Department Response to Security Events
   i. OP 3504, Emergency Communications
   j. OP 3507, Emergency Radiation Exposure Control
   k. OP 3508, On-Site Medical Emergency Procedure
   l. OP 3511, Off-Site Protective Action Recommendations
   m. OP 3513, Evaluation of Off-Site Radiological Conditions
   n. OP 3531, Emergency Call-in Method
   o. OP 3541, Activation of the Technical Support Center (TSC)
   p. OP 3542, Operation of the Technical Support Center (TSC)
   q. OP 3544, Operation of the Operations Support Center (OSC)
   r. OP 3545, Activation of the Emergency Operations Facility/Recover Center (EOF/RC)
   s. OP 3546, Operation of the Emergency Operations Facility/Recover Center (EOF/RC)
   t. OP 3547, Security Actions During an Emergency
   u. AP 6807, Collection, Temporary Storage and Retrieval of QA Records

PRECAUTIONS/LIMITATIONS

1. Refer to OP 3504 for alternate methods of communication in the event that primary methods fail.

DEFINITIONS

1. Alternate Communicator: this position will be filled by a qualified Shift Technical Advisor as indicated on Appendix O of the Emergency Call-In List. Alternate Communicators are expected to be able to gather data, fill out appropriate forms, communicate information over the phone to appropriate officials and make plant announcements.

2. Control Room Communicator: (CRC): this position will be filled by a Chemistry Technician. CRCs are expected to communicate information over the phone to appropriate officials and make plant announcements.

3. Elevated Release: An elevated radiological release is any release discharged from the plant stack.

4. Ground Release: A radiological ground release is any release that is not discharged from the plant stack.

NOTES

- The responsible individual may assign actions required to other personnel as appropriate. The designated individual, however, has the overall responsibility for the execution of the checklist.
- Record time and initials as required.
- Steps may be performed concurrently or out of sequence.
- Some steps have multiple signature lines, based on event level. The step should be initialed for each event level it is completed for. If an event escalates, each step with that event level designator should be rechecked to ensure no further action is required.

PED Name (print): LAWRENCE E. DOANE Date: June 18, 2004

		Time/Date	Initials
1.0	Immediate Actions		
1.1.	It has been determined that an EAL has been reached per AP 3125. Record time and date of entry.	U 0650 / 6/18/04 A / S / G /	[signature]
1.2.	IF a GENERAL EMERGENCY, THEN implement OP 3511, Off-Site Protective Action Recommendations.	G N/A /	
1.3.	If a release (as indicated by Stack Hi Range (RM-17-155) WARN or HIGH alarm or indication of a ground release) is in progress or expected, ensure that OP 3513, Evaluation of Off-Site Radiological Conditions, is implemented by the SM/PED or Radiological Assistant or their qualified designee.	A N/A / S / G /	

		Time/Date	Initials
1.4.	Determine the immediate personnel response to be taken.	U 0657 / 6/18/04 A / S / G /	
1.5.	Call the Security Shift Supervisor to:.		
1.5.1.	Implement OP 3547, Security Actions During an Emergency	(circle one) U A S G 0704 / 6/18/04	
1.5.2.	Request an Alternate Communicator to report to the Control Room per OP 3531, Emergency Call-In Method, as warranted.	N/A / 6/18/04	

NOTES

IF an emergency classification is entered due to a security condition, THEN staffing facilities and performing accountability may put personnel at risk. Therefore, during a Code Red Event:

- the alarm tone shall not be sounded,
- personnel shall not be directed to their facilities and,
- the Gai-Troncis announcement will be made in accordance with OP 3132, Operations Department Response to Security Events.

1.6.	Request Control Room Communicator (CRC) to report to Control Room	(circle one) U A S G 0655 / 6/18/04	
1.7.	Prepare Gai-Tronics announcement for applicable emergency classification. (VYOPF 3540.01-05)	U 0659 / 6/18/04 A / S / G /	
1.8.	Make Gai-Tronics announcement.	U 0700 / 6/18/04 A / S / G /	

	Time/Date	Initials
1.9. Request that extra Operations personnel report to the Control Room or OSC per PED request.	0710 6/18/04	

NOTES

- States' notification must be initiated within 15 minutes of emergency classification declaration.
- SM/PED retains responsibility for off-site States' notification (NAS Phone) until relieved by the Site Recovery Manager.
- The Shift Manager may, at his discretion, have all the Control Room telephone ringers except the Shift Technical Advisor's (STA) desk phone shut off to alleviate distractions in the control room. (UND-98012_01)

1.10. Prepare VYOPF 3540.06, Emergency Classification and PAR Notification/Upgrade Form for applicable emergency classification. Use the following criteria for Step B.2, notification of a radioactive release in progress:	U	0702 / 6/18/04	
	A	/	
	S	/	
	G	/	

1.10.1. If no radiation release is expected, then check the first box, "no radiation release related to this event".

Time/Date Initials

1.10.2. Check release BELOW federally approved operating limits if:

1.10.2.1. An elevated release as indicated by an increase in radiation levels on Stack Gas Radiation monitors RM-17-156 or 157 or confirmed by stack gas sample less than ODCM limits, due to this event,

OR

1.10.2.2. A ground release of radiation less than the ODCM limits by sample or field monitoring as confirmed by the Chemistry Department

1.10.3. Check release ABOVE federally approved operating limits if:

1.10.3.1. An elevated release of radiation as indicated by a **HIGH Alarm** on RM-17-156 or 157 or confirmed by stack gas sample greater than ODCM limits due to the event,

OR

1.10.3.2. A ground release of radiation greater than the ODCM limits by sample or field monitoring as confirmed by the Chemistry Department.

		Time/Date Completed	Initials
1.11.	Notify VT/NH/MA State Police Agencies per VYOPF 3540.06.	U 0721 / 6/18/04	
		A /	
		S /	
		G /	
1.12.	IF commercial telephone service is degraded, THEN instruct Communicator to inform the States of this condition and request that all State call-back communications should occur through the NAS Phone. (Use Remarks section of VYOPF 3540.06 to note directive.)	U N/A /	
		A /	
		S /	
		G /	
1.13.	Fax copy of VYOPF 3540.06 to each State to supplement phone call.	U /	
		A /	
		S /	
		G /	
1.14.	After completion of the State's notification, SM/PED acknowledges that the States' notification has been completed.	U 0721 / 6/18/04	
		A /	
		S /	
		G /	
1.15.	Record call-back from State officials concerning plant conditions:		
	VT Official Healy	U 0717 / 6/18/04	
	VT Official	A /	
	VT Official	S /	
	VT Official	G /	
	NH Official Banerjee	U 0728 / 6/18/04	
	NH Official	A /	
	NH Official	S /	
	NH Official	G /	
	MA Official Savatano	U 0825 / 6/18/04	
	MA Official	A /	
	MA Official	S /	
	MA Official	G /	

	Time/Date	Initials

1.16. IF State officials have not made contact with the plant within one hour, THEN recall State Police by utilizing the appropriate NAS Phone number or commercial telephone back-up number listed on VYOPF 3540.06. Record contact above.

1.17. IF the SRM or TSC Coordinator has not assumed overall responsibility for the response effort, and conditions indicate that escalation is necessary, THEN the SM/PED proceeds with the notification for the new emergency classification by repeating those steps, 1 through 1.16, that have multiple event level sign-offs.

A N/A /
S /
G /

NOTE

NRC notification must be initiated immediately after the States' notification, but not later than one (1) hour after the emergency classification declaration.

1.18. Prepare message for NRC using VYAPF 0156.01.

U 0742 10/15/04 BRP
A /
S /
G /

1.19. Notify NRC Headquarters on the FTS Emergency Notification System (ENS) phone by dialing the first number listed below, using all 11 digits. If the first number is busy, use the second, etc.

1-301-816-5100
1-301-951-0550
1-301-415-0550

U 0748 / 10/18/04 TSR
A /
S /
G /

1.20. IF contact cannot be established using the FTS System, THEN call the NRC Operations Center via the commercial telephone system, using (in the order listed), one of the telephone numbers listed above and inform the NRC Operations Center of the problem with the FTS System.

U N/A /
A /
S /
G /

		Time/Date	Initials
1.21.	Upon establishing communications, provide message using VYAPF 0156.01, Event Notification Worksheet.	U 0748 / 6/18/04 A / S / G /	TSP
1.22.	IF desired by NRC Headquarters, THEN maintain an open and continuous communications channel, until relieved by the TSC staff or until continuous communications are no longer necessary.	/	N/A
1.23.	When contacted by the Public Affairs Department, provide a brief description of the event (e.g., Plant power level? Involvement of outside agencies? Injuries?). PA Contact Name: DAVE MCELWEE Time: 1030	U 1030 / 6/18/04 A / S / G /	
1.24.	When contacted by the TSC Coordinator or EOF Coordinator provide information on event classification and plant conditions.	U N/A A / S / G /	
1.25.	Request SSS contact outside agencies for assistance (fire, law enforcement, or medical rescue personnel and related equipment) as needed to deal with the event.		
	Fire (CONTROL ROOM CONTACTED VERNON FD)	0650 / 6/18/04	
	Medical	N/A /	
	Law Enforcement (in conjunction with the Security Shift Supervisor)	N/A /	
1.26.	Initiate and coordinate the initial on-site assistance team activities (until relieved by TSC Coordinator) as follows:		
1.26.1.	Prioritize job tasks to mitigate and control the emergency condition.	0650 / 6/18/04	
1.26.2.	Ensure that the applicable work control process defined in AP 0021, Work Orders, is used.	0650 / 6/18/04	

		Time/Date	Initials
1.26.3.	Authorize emergency dose commitments for required job tasks in accordance with OP 3507, Emergency Radiation Exposure Control.	A N/A S / G /	
1.26.4.	Brief the TSC Coordinator on job tasks initiated, and continue to coordinate job priorities with the TSC Coordinator.	U N/A A / S / G /	
1.27.	Verify the Vermont Yankee State Liaison Engineer has been notified per AP 0156	U 1030 / 6/16/09	

	Time/Date	Initials

2.0 Subsequent Actions

2.1. Assess plant conditions periodically and be prepared to initiate escalation of emergency classification to a more severe condition in the absence of the TSC Coordinator and the Site Recovery Manager.

U 1000 / 6/16/04 [signature]
A ___ / ___
S ___ / ___

2.2. IF conditions warrant an escalation to a GENERAL EMERGENCY, THEN implement OP 3511, Off-Site Protective Action Recommendations.

G N/A / ___

2.3. Maintain responsibility for the implementation of the VY Emergency Plan until relieved by the TSC Coordinator or Site Recovery Manager. This includes the following responsibilities:

2.3.1. Escalation of the emergency.

NOTE

SM/PED retains responsibility for off-site States' notification until relieved by the Site Recovery Manager.

2.3.2. Notification of off-site States' authorities. (NAS Phone)

2.3.3. Notification of off-site NRC authorities. (FTS ENS Phone)

2.3.4. Authorization and transmittal of off-site protective action recommendations (PARs).

		Time/Date	Initials
2.4.	Record the time when and the name of either the TSC Coordinator or SRM who calls to assume the responsibility for implementation of the VY Emergency Plan.		
	TSCC called at: N/A	(circle one) U A S G	
	TSCC name: N/A	N/A	
	SRM called at: N/A	(circle one) U A S G	
	SRM name: N/A	N/A	
2.5.	Record time when the TSC Coordinator calls to assume responsibility for the deployment of the AOs.	(circle one) U A S G	
	TSCC called at: N/A	/	
2.6.	In concert with the TSC Coordinator and the Site Recovery Manager, provide information to assist with the final closeout of the emergency condition.	1245 ~~1315~~ 16/19/04	KO

FINAL CONDITIONS

1.	When the event conditions no longer exist, as approved by the TSC Coordinator, or Site Recovery Manager, announce on the plant page system that the event is terminated.	1245 16/19/04	KO
2.	Summarize all actions and resultant conditions in the Shift Manager's Log.	1245 16/19/04	KO
3.	Forward a completed copy of this procedure to the Emergency Plan Coordinator for filing in accordance with AP 6807.	1245 16/19/04	KO

EMERGENCY CLASSIFICATION AND PAR NOTIFICATION/UPGRADE FORM (Continued)

I. MESSAGE

This is (Name: Bill Pittman ; Title: Asst Gen Mgr)-from the Vermont Yankee Nuclear Power Station in Vernon, Vermont. Please do not interrupt until the entire message is completed.

A. We have (complete either 1 or 2)

☑ 1. **Declared a** (check one)

- ☑ Unusual Event
  - ☐ Unusual Event Terminated
- ☐ Alert
- ☐ Site Area Emergency
- ☐ General Emergency

at 0650 hours due to AP 3125 EAL alpha-numeric designator U-4-a.

☐ 2. **Upgraded the Protective Actions for the General Emergency which was declared at _____ hours.**

B. Plant Conditions:

1. The Plant is: (Check one)
   - ☐ continuing normal operation
   - ☐ reducing power levels
   - ☑ shut down
2. There is: (Check one)
   - ☑ no radiation release related to this event
   - ☐ a release of radiation BELOW federally approved operating limits in progress, related to this event
   - ☐ a release of radiation ABOVE federally approved operating limits in progress, related to this event
3. Present Meteorological conditions:
   Wind speed 15.2 mph
   Wind direction from 92.2 degrees.

C. At the present time, we recommend the following protective actions:

☑ None ☐ As Follows

State	Town	Shelter	Evac
VT	Brattleboro	☐	☐
	Dummerston	☐	☐
	Guilford	☐	☐
	Halifax	☐	☐
	Vernon	☐	☐
NH	Chesterfield	☐	☐
	Hinsdale	☐	☐
	Richmond	☐	☐
	Swanzey	☐	☐
	Winchester	☐	☐
MA	Bernardston	☐	☐
	Colrain	☐	☐
	Gill	☐	☐
	Greenfield	☐	☐
	Leyden	☐	☐
	Northfield	☐	☐
	Warwick	☐	☐

D. Follow your State procedures for the designated Classification

E. (At the initial General Emergency declaration, state the following:)

We recommend you implement your State KI plan.

II. PREPARER/APPROVAL SIGNATURES

Form filled out by (print and sign): Wm P. Pittman Jr. Wm P. Pittman Jr.

Authorized by (print and sign): LE Dow LE Dow 0702 / 06/18/04
(PED / TSCC / SRM) Time/Date

III. NOTIFICATION TIME AND ACKNOWLEDGEMENT: (NOTE: INITIAL CONTACT WITH STATES MUST BE MADE WITHIN 15 MINUTES OF DECLARATION OR UPGRADE)

Time notification initiated: VT 0711 ~~0717~~ NH 0715 MA 0721

Acknowledge of message: VT Healy ~~Healy~~ NH McFadzen MA Joe Bye
Name Name Name

IV. FAX NOTIFICATION FORM TO THE STATES (NOTE: THIS IS TO SUPPLEMENT THE CALL)

Time notification initiated: VT 0703 / *0711 NH 0702 / 0715 MA 0703 / 0721

REMARKS:

* New NAS phone did not work properly, Calls were made one at a time using old "orange" NAS phone

UNUSUAL EVENT ANNOUNCEMENT

1. Before making the announcement, have the Shift Manager/Plant Emergency Director (SM/PED) authorize the prepared announcement.

   L. E. Doane [signature] / 6/18/04 / 0657
   SM/PED Authorization (print/sign) Date Time

2. Turn the PAGE SYS VOLUME & ALARM TONE SELECT switch to the ALERT position.

3. Turn the ALARM TONE CONTROL switch to the ON position for 10 seconds then return to the OFF position.

> **NOTE**
>
> Do not make plant announcement during a Code Red event.

4. Make the following Gai-Tronics announcement:

   "Attention all personnel. Attention all personnel. UNUSUAL EVENT, UNUSUAL EVENT, UNUSUAL EVENT.

   An UNUSUAL EVENT has been declared at 0640 **hours due to:**

   (describe conditions and affected areas) an unplanned on site fire that was not extinguished in 10 mins.

   The following personnel *(if applicable)* N/A

   report to N/A

   All other personnel stay clear of the affected area." *(If applicable)*

5. Repeat the announcement.

6. Turn the PAGE SYS VOLUME & ALARM TONE SELECT Switch to the OFF position.

EVENT NOTIFICATION WORKSHEET

Event Date	6/18/04
Event Time	~~0748~~ 0650

Rx Power Level	Shutdown
RMS Position	☐ Run ☐ Start & Hot Stby
	☐ Refuel ☑ Shutdown

Notification required per: 10 CFR 50.72(b)(2)(iv)(B) 10CFR50.72(a)(1)(i) (list all applicable - see attached checklists for assistance)

Event Description:
1HR Declaration of an UE (U-4-a) Inplant Fire not extinguished w/in 10 min (@ 0650)
4HR RPS Actuation when critical

Actions Taken (ref. appl. T.S.):

Actions Taken:
- ☑ CR per AP 0009 initiated
- ☑ Log Entry made
- ☑ Tech Spec LCO entered

1 Hour Notifications:	☒ NRC Resident	☒ NRC Ops Center	☒ Liaison Eng.	☒ DCO	☒ ECOO	☒ VY SVP	☒ VY GM	☐ Other
Name of Ind.	D. Pelton	John MacKinnon	D. McElwee	E. Harris	J. Herron	J. Thayer	K. Sutton	N/A
Time	0748	0748	0850	0857	0900	0912	0900	N/A
Event Number		40827		(TSC Coord.)				

☒ 4 Hour Notifications: ☒ NRC Resident ☒ NRC Ops Center ☒ Liaison Eng. ☒ DCO ☐ Other
☐ 8 Hour Notifications:

Name of Ind. John McKinnon
Time 0748
Event Number 40827

NOTE

Attach a copy of this form to the original Condition Report

Prepared by: JR Pelton (Print/Sign) 6/18/04 Date

Approved by: LEDOANE JE Doan (Print/Sign) 0747 / 06/18/04 Date

(check one) ☑ SM ☐ PED ☐ DCO ☐ TSC

10CFR50.72(a)(1)(i)		Emergency Events
	☒	Unusual Event
	☐	Alert
	☐	Site Area Emergency
		General Emergency

10CFR50.72(c)		Supplemental Reports
(1)i	☐	Further degradation of safety or additional EAL declaration
(1)ii	☐	Change in Emergency Class
(1)iii	☐	Termination of Emergency Class
(2)i	☐	Results of evaluations/assessments
(2)ii	☐	Effectiveness of response/protective measures
(2)iii	☐	Plant behavior not understood
	☐	Retraction

10CFR50.72(b)		1 Hour Non-Emergency
(1)	☐	Tech. Spec. Deviation per 50.54(x)

OTHER 10CFR		1 Hour Non-Emergency
20.2202(a)	☐	Release of Material/Individual Exposure
20.1906 (d)(1)	☐	Excess Removable Contamination
20.1906 (d)(2)	☐	Excess Package Dose Rates
40.64(c)	☐	SNM Theft/Diversion
73.71(a)	☐	Loss of any shipment of SNM or Spent Fuel
73.71(b)	☐	SNM Theft/Diversion
73.71(b)	☐	Sabotage
73.71(b)	☐	Entry of Unauthorized Person(s)
70.52(b)	☐	SNM Theft/Diversion
70.52(a)	☐	Accidental Criticality
20.2201(a)(1)(i)	☐	Theft or Loss of Licensed Material

I LPC 1

10CFR50.72(b)2		4 Hour Non-Emergency
(i)	☐	Tech. Spec. Req'd Shutdown
(iv)A	☐	Valid Signal for ECCS Dischrg into RCS
(iv)B	☒	RPS Actuation When Critical
(xi)	☐	State Notification/News Release

10CFR40.72(b)3		8 Hour Non-Emergency
(ii)	☒	Seriously Degraded Condition/Unanalyzed Condition
(iv)A	☐	System Actuation
(v)A	☐	Safe S/D Capability
(v)B	☐	RHR Capability
(v)C	☐	Control of Rad Release
(v)D	☐	Accident Mitigation
(xii)	☐	Offsite Medical – Contaminated Person
(xiii)	☐	Major Loss of Emerg Assessment and Communications

OTHER Notifications		
	☐ NPDS Permit Non-compliance	[notify Chem Mgr]
	☒ HAZMAT Event	[notify per OP 2106]
	☒ 24-hour Release of Material/Individual Exposure 20.2202(b)	

Reportable Actuations	(INS911307)	
	☒	Automatic Depressurization System (ADS)
	☒	Core Spray System
	☐	Emergency Diesel Generators
	☐	High Pressure Coolant Injection System (HPCI)
	☒	Low Pressure Coolant Injection System (LPCI)
	☐	Primary Cont. Isolation System
		☐ GRP 1 ☐ GRP 4
		☒ GRP 2 ☐ GRP 5
		☐ GRP 3 ☐ GRP 6
	☒	Reactor Protection System (RPS)
	☒	Reactor Core Isolation Cooling System (RCIC)
	☐	RHR Containment Cooling (i.e., Torus water cooling, containment spray)
	☒	Drywell RRUs

EVENT NOTIFICATION WORKSHEET

Event Date	6/18/04
Event Time	1245

Rx Power Level	0%
RMS Position	☐ Run ☐ Start & Hot Stby
	☐ Refuel ☒ Shutdown

Notification required per: 10 CFR 50.72(c)(1)(i)(ii) (list all applicable - see attached checklists for assistance)

Event Description:

AT 1245 hours

TERMINATION of UNUSUAL EVENT FOR NRC EVENT #40827. ~~DECLARED AT 1245 hours DST~~

Actions Taken (ref. appl. T.S.):

Actions Taken:
- ☐ CR per AP 0009 initiated
- ☑ Log Entry made
- ☐ Tech Spec LCO entered

1 Hour Notifications:	☐ NRC Resident	☒ NRC Ops Center	☐ Liaison Eng.	☐ DCO	☐ ECOO	☐ VY SVP	☐ VY GM	☐ Other
Name of Ind.		H. CROUCH						
Time		1301						
Event Number		N/A						

☐ 4 Hour Notifications:
☐ 8 Hour Notifications: ☐ NRC Resident ☐ NRC Ops Center ☐ Liaison Eng. ☐ DCO ☐ Other

Name of Ind.
Time
Event Number

NOTE

Attach a copy of this form to the original Condition Report

Prepared by: DAVID HALLQUIST Dave Hallquist / 6/18/04
(Print/Sign) Date

Approved by: Ken Oliver KO Oliver /
(Print/Sign) Date

(check one) ☒ SM ☐ PED ☐ DCO ☐ TSC

10CFR50.72(a)(1)(i)		Emergency Events
	☐	Unusual Event
	☐	Alert
	☐	Site Area Emergency
		General Emergency

10CFR50.72(c)		Supplemental Reports
(1)i	☐	Further degradation of safety or additional EAL declaration
(1)ii	☐	Change in Emergency Class
(1)iii	☒	Termination of Emergency Class
(2)i	☐	Results of evaluations/assessments
(2)ii	☐	Effectiveness of response/protective measures
(2)iii	☐	Plant behavior not understood
	☐	Retraction

10CFR50.72(b)		1 Hour Non-Emergency
(1)	☐	Tech. Spec. Deviation per 50.54(x)

OTHER 10CFR		1 Hour Non-Emergency
20.2202(a)	☐	Release of Material/Individual Exposure
20.1906 (d)(1)	☐	Excess Removable Contamination
20.1906 (d)(2)	☐	Excess Package Dose Rates
40.64(c)	☐	SNM Theft/Diversion
73.71(a)	☐	Loss of any shipment of SNM or Spent Fuel
73.71(b)	☐	SNM Theft/Diversion
73.71(b)	☐	Sabotage
73.71(b)	☐	Entry of Unauthorized Person(s)
70.52(b)	☐	SNM Theft/Diversion
70.52(a)	☐	Accidental Criticality
20.2201(a)(1)(i)	☐	Theft or Loss of Licensed Material

LPC 1

10CFR50.72(b)2		4 Hour Non-Emergency
(i)	☐	Tech. Spec. Req'd Shutdown
(iv)A	☐	Valid Signal for ECCS Dischrg into RCS
(iv)B	☐	RPS Actuation When Critical
(xi)	☐	State Notification/News Release

10CFR40.72(b)3		8 Hour Non-Emergency
(ii)	☐	Seriously Degraded Condition/Unanalyzed Condition
(iv)A	☐	System Actuation
(v)A	☐	Safe S/D Capability
(v)B	☐	RHR Capability
(v)C	☐	Control of Rad Release
(v)D	☐	Accident Mitigation
(xii)	☐	Offsite Medical – Contaminated Person
(xiii)	☐	Major Loss of Emerg Assessment and Communications

OTHER Notifications		
	☐ NPDS Permit Non-compliance	[notify Chem Mgr]
	☐ HAZMAT Event	[notify per OP 2106]
	☐ 24-hour Release of Material/Individual Exposure 20.2202(b)	

Reportable Actuations	(INS911307)
☐	Automatic Depressurization System (ADS)
☐	Core Spray System
☐	Emergency Diesel Generators
☐	High Pressure Coolant Injection System (HPCI)
☐	Low Pressure Coolant Injection System (LPCI)
☐	Primary Cont. Isolation System
	☐ GRP 1 ☐ GRP 4
	☐ GRP 2 ☐ GRP 5
	☐ GRP 3 ☐ GRP 6
☐	Reactor Protection System (RPS)
☐	Reactor Core Isolation Cooling System (RCIC)
☐	RHR Containment Cooling (i.e., Torus water cooling, containment spray)
☐	Drywell RRUs

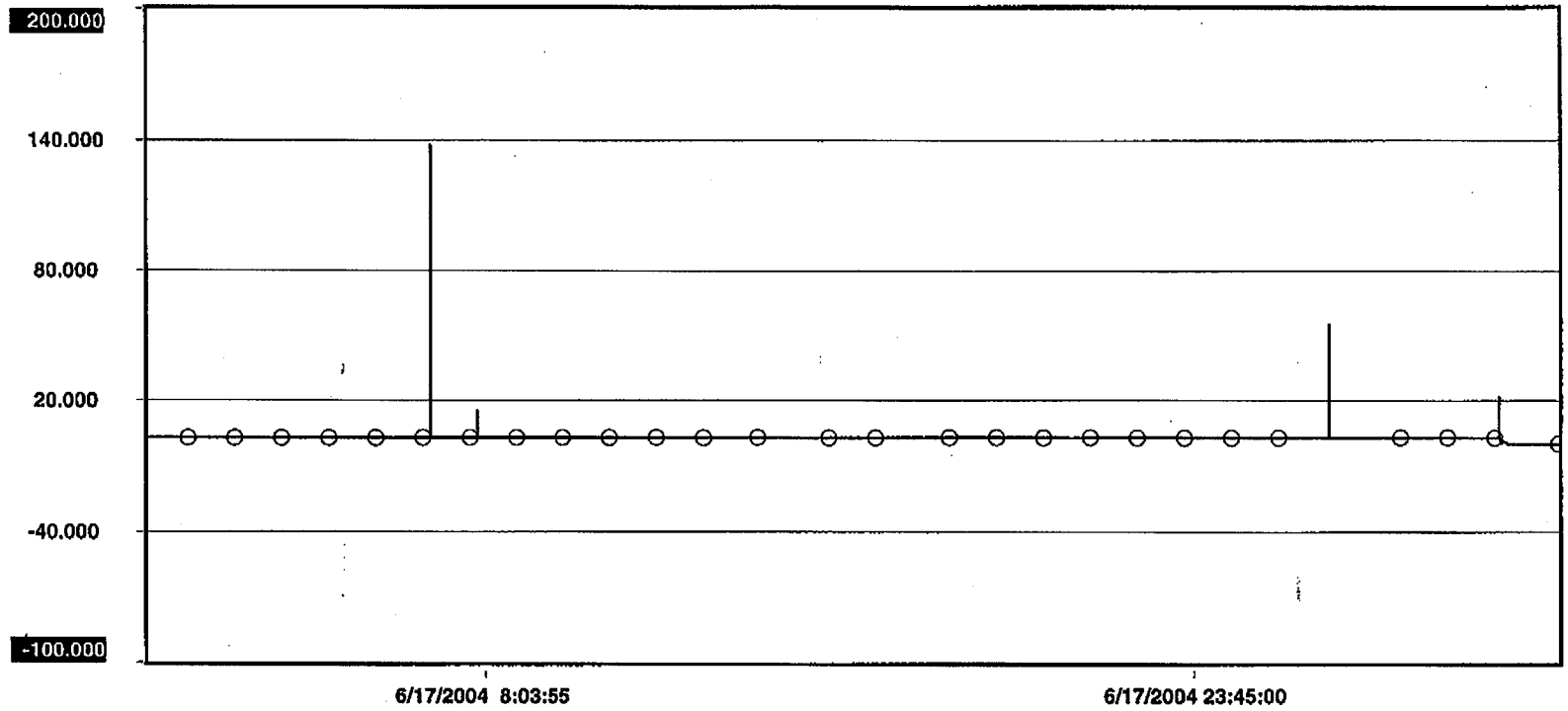
VTY	CTP	PLANT MODE
PSS	0.1 %	SHUTDOWN

One Single-Variable Trend

TREND_1 6/18/2004 8:59:46

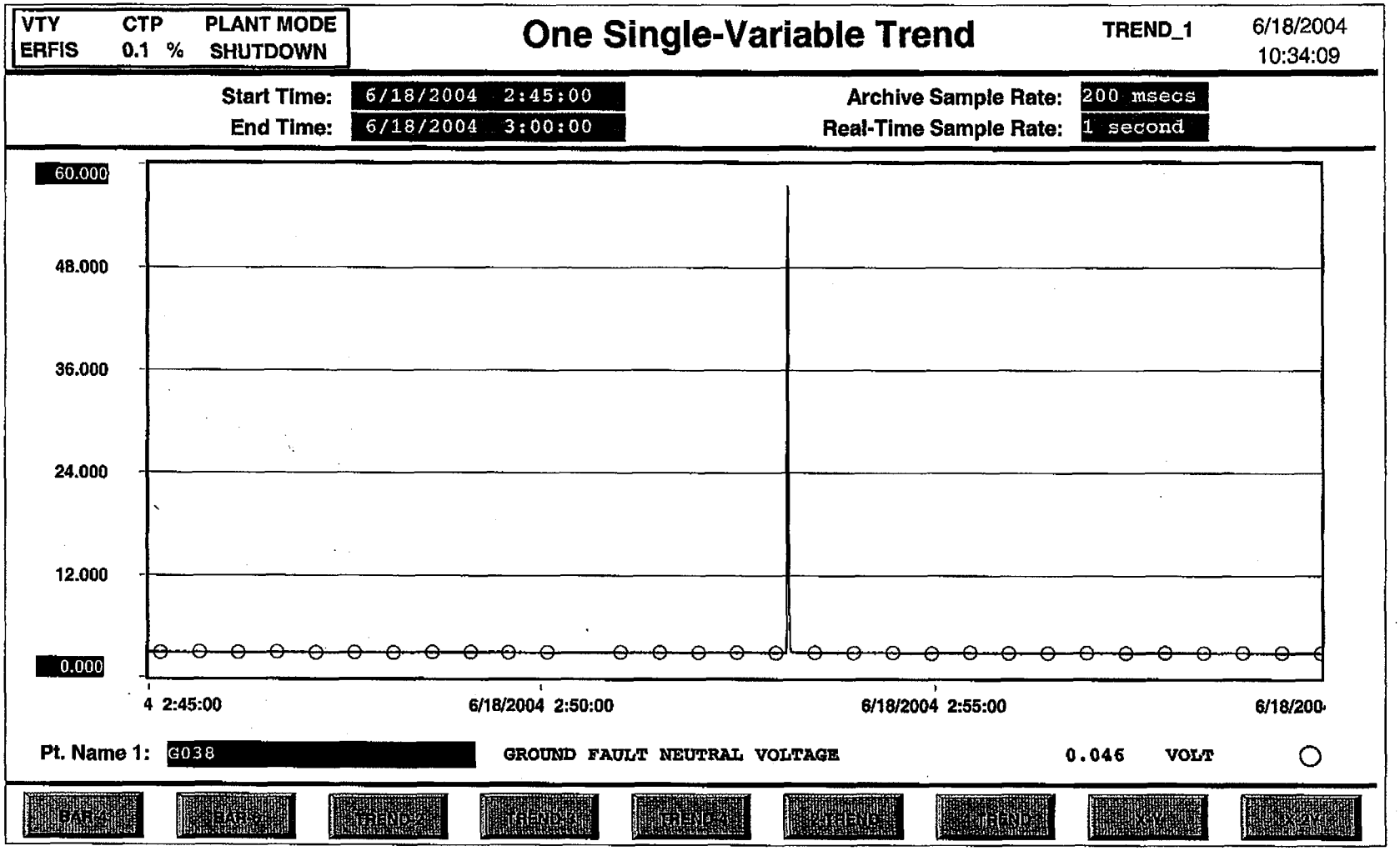
Start Time: 6/17/2004 0:37:50
End Time: 6/18/2004 8:00:00

Archive Sample Rate: 1 second
Real-Time Sample Rate: 1 second



Pt. Name 1: G038 GROUND FAULT NEUTRAL VOLTAGE 0.000 VOLT

BAR4 BAR5 TREND2 TREND3 TREND4 X-TREND Y-TREND XY X2Y


VTY CTP PLANT MODE
ERFIS 0.1 % SHUTDOWN
One Single-Variable Trend
TREND_1
6/18/2004
10:34:09
Start Time: 6/18/2004 2:45:00
End Time: 6/18/2004 3:00:00
Archive Sample Rate: 200 msecs
Real-Time Sample Rate: 1 second
60.000
48.000
36.000
24.000
12.000
0.000
4 2:45:00
6/18/2004 2:50:00
6/18/2004 2:55:00
6/18/200
Pt. Name 1: G038
GROUND FAULT NEUTRAL VOLTAGE
0.046
VOLT
BAR2
BAR1
TREND2
TREND3
TREND4
TREND1
TREND
X-Y
X-2Y

VTY	CTP	PLANT MODE
ERFIS	0.1 %	SHUTDOWN

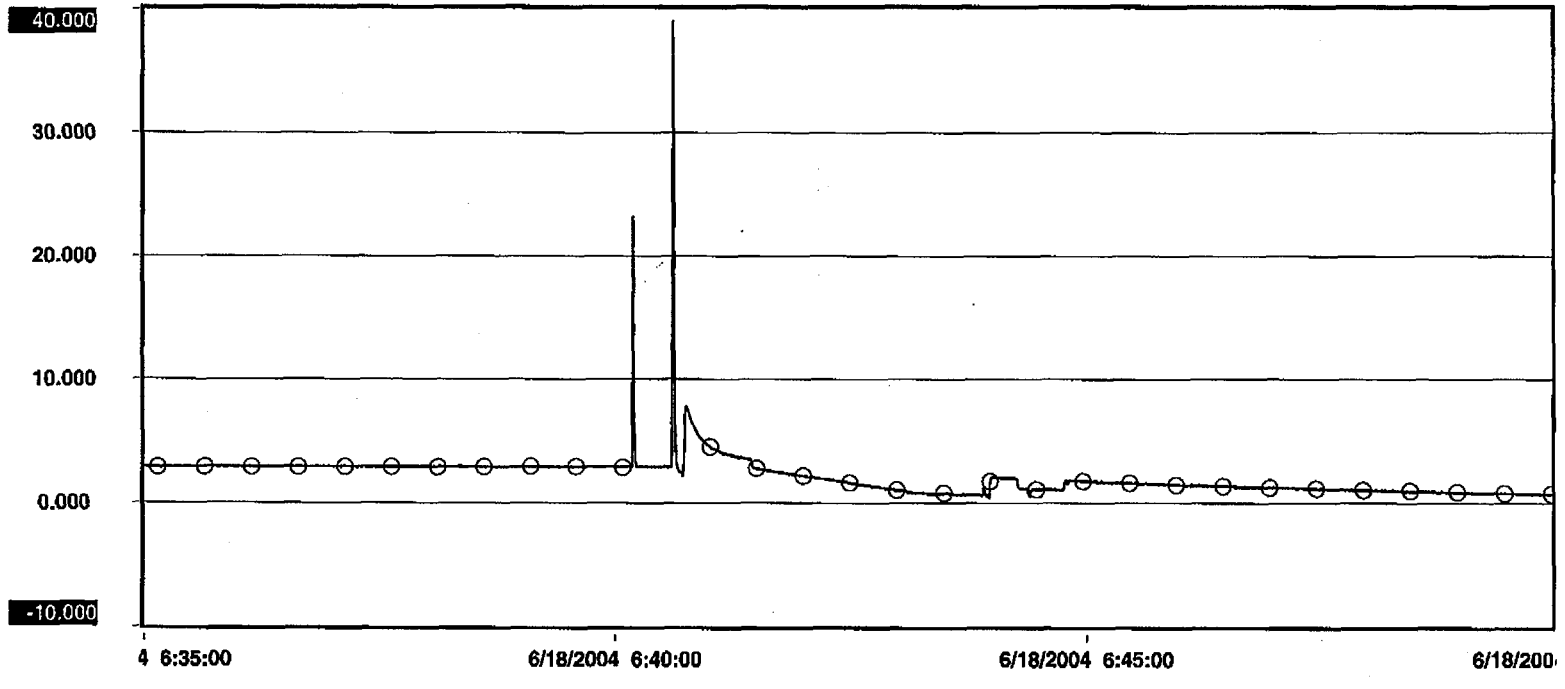
One Single-Variable Trend

TREND_1

6/18/2004
10:31:28

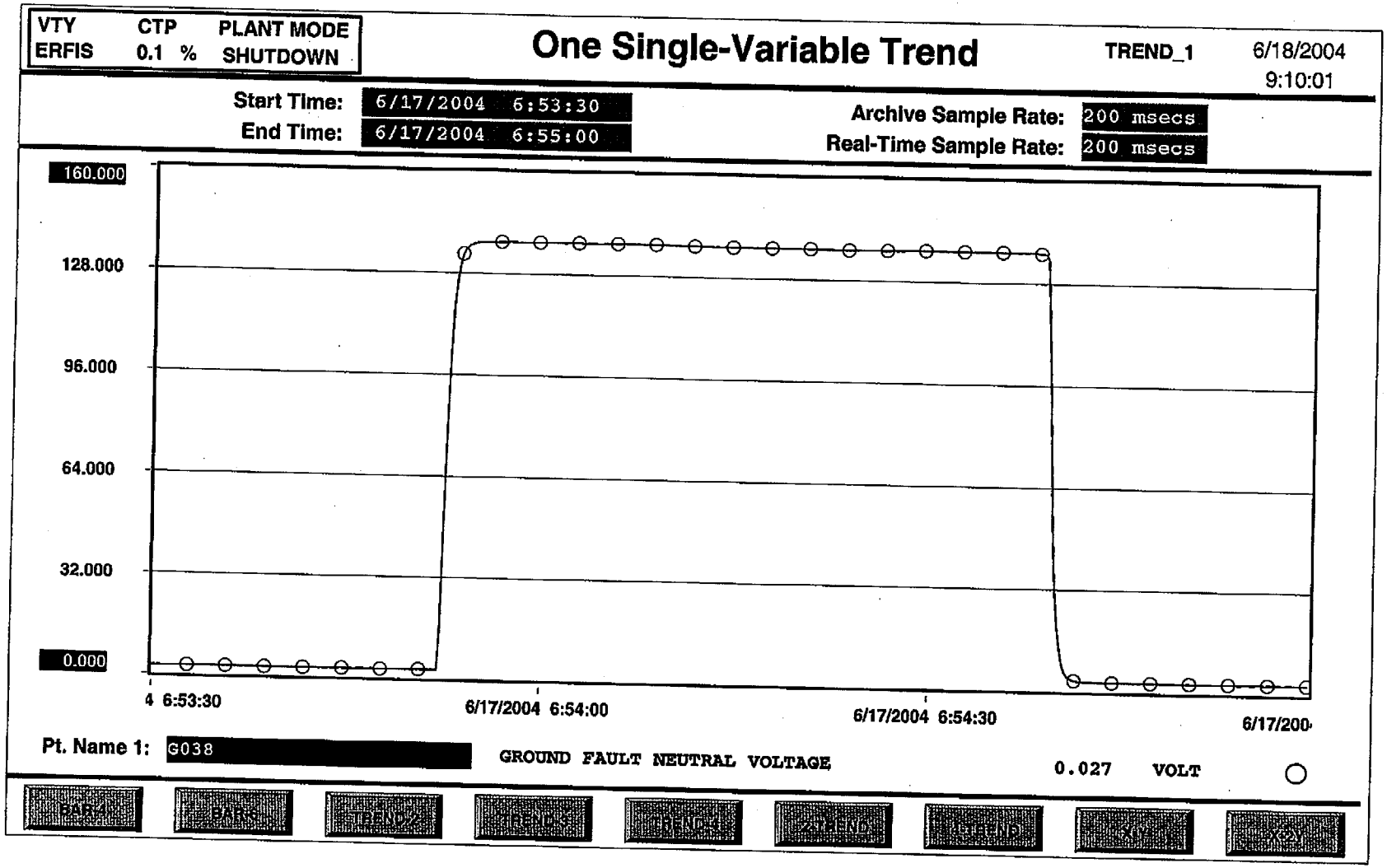
Start Time: 6/18/2004 6:35:00
End Time: 6/18/2004 6:50:00

Archive Sample Rate: 200 msecs
Real-Time Sample Rate: 1 second



Pt. Name 1: G038 GROUND FAULT NEUTRAL VOLTAGE 0.027 VOLT

BAR1 BAR2 TREND2 TREND3 TREND 21TREND TREND XY XY


VTY
ERFIS
CTP
0.1 %
PLANT MODE
SHUTDOWN
One Single-Variable Trend
TREND_1
6/18/2004
9:10:01
Start Time: 6/17/2004 6:53:30
End Time: 6/17/2004 6:55:00
Archive Sample Rate: 200 msecs
Real-Time Sample Rate: 200 msecs
160.000
128.000
96.000
64.000
32.000
0.000
4 6:53:30
6/17/2004 6:54:00
6/17/2004 6:54:30
6/17/200
Pt. Name 1: G038
GROUND FAULT NEUTRAL VOLTAGE
0.027 VOLT
PARM
BARS
TREND 2
TREND 3
TREND 4
2 TREND
4 TREND
XY 1
XY 2

Comments from review of the Alarm Typer

2004 - 2037

1. Indications that the 81-1T breaker cycled twice (06:40:38)
2. UPS-2A tripped
    - Multiple UPS-2A Alarm Summaries and resets
3. Stop Valves #1 & #4 cycled several times in under one second
4. Low voltage condition on Buses 1, 2, 3, 4, 8 & 9
5. ERFIS had problems finding Rod 18-03 (06:41:25)
6. When resetting scrams
    - Manual Scram Channel B: Norm – Trip – Norm
    - Manual Scram Channel A: Norm

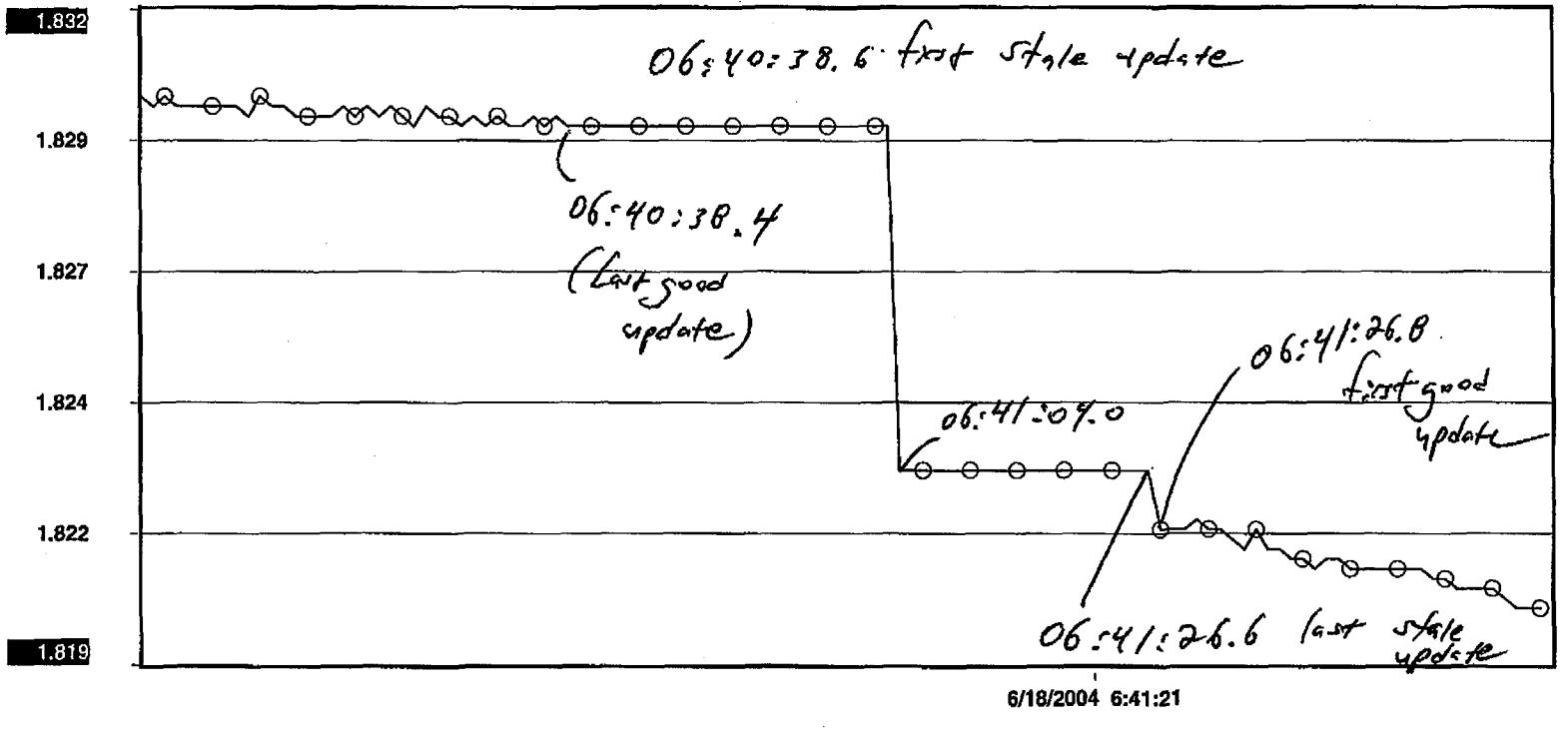
VTY	CTP	PLANT MODE
VYPPC2	0.3 %	SHUTDOWN

One Single-Variable Trend

TREND_1 6/21/2004 8:35:22

Start Time: 6/18/2004 6:40:01
End Time: 6/18/2004 6:42:00

Archive Sample Rate: 1 second
Real-Time Sample Rate: 1 second



Pt. Name 1: M117 DRYWELL PRESSURE A 0.035 PSIG

BAR4 BAR6 TREND2 TREND3 TREND4 2-TREND 4-TREND XY X-Y

Entergy	CONDITION REPORT	CR-VTY-2004-01989

Originator: Bacala,Glenn J
Originator Group: Operations Staff
Supervisor Name: Amirault,Laurence P
Discovered Date: 06/17/2004 08:10

Originator Phone: 2577711
Operability Required: Y
Reportability Required: Y
Initiated Date: 06/17/2004 08:23

Condition Description:
Generator Ground

At 06:53 Annunicator 7-A-2 (Gen Gnd Current Hi) came in.

Immediate Action Description:
Checked the Multifunction relay in the back panels and discovered "Target #2 Neutral Overvolt" alarm locked in. Also discovered the 59/N mechanical target flagged. Contacted ISO and VELCO nothing on grid could be attributed to this event. ERFIS points G036 (ground fault neutral voltage) rose from a value of 2.9V to 138V and G003 (Generator field volts rose from a value of 280V to about 290V. The ground fault voltage remained high for 1 minute. Alarm was reset after about five minutes. Contacted S Gunnip, system engineering, Ops Mgr and General manager

Suggested Action Description:
Contine investigation into this event to determine and correct cause

EQUIPMENT:

Tag Name	Tag Suffix Name	Component Code	Process System Code
22KV	EQUIPMENT	22KV	

REFERENCE ITEMS:

Type Code	Description
CR	2004-2015

TRENDING (For Reference Purposes Only):

Trend Type	Trend Code
KEY WORDS	KW-RISK TO GENERATION
KEY WORDS	KW-GROUND (ELECTRICAL)
KEY WORDS	KW-UNUSUAL EVENT RELATED 6/18/04
HOW IDENTIFIED	HI-SELF-REVEALING

Entergy	ADMIN	CR-VTY-2004-01989

Initiated Date: 6/17/2004 8:23 **Owner Group :** Eng SUP EWC EFIN Mgmt

Current Contact: APP

Current Significance: B - ACE

Closed by:

Summary Description:

Generator Ground

At 06:53 Annunicator 7-A-2 (Gen Gnd Current Hi) came in.

Remarks Description:

Closure Description:

Entergy	OPERABILITY	CR-VTY-2004-01989

OperabilityVersion: 1

Operability Code: NOT REQUIRED

Immediate Report Code: NOT REPORTABLE

Performed By: Doane,Lawrence E 06/17/2004 09:19

Approved By: Doane,Lawrence E 06/17/2004 09:20

Operability Description:

The component and equipment it protects is NNS. Additionally, the protective relaying and alarms functioned as required. If further investigation reveals a protective relaying malfunction occured, then this Operability Desc will require revision.

Approval Comments:

Entergy	ASSIGNMENTS	CR-VTY-2004-01989

Version: 1

Significance Code: B - ACE

Classification Code: B

Owner Group: Eng SUP EWC EFIN Mgmt

Performed By: Pallang,Alexander P 06/18/2004 17:48

Assignment Description:

Screening Data
□Significance:□B - ACE
□Owner :□Eng SUP EWC EFIN Mgmt
□Presented By:□Harms, Ed
Comments:□Reference CR 2004-2015
□
A Human Performance Evaluation VYAPF 0009.05 is required for all HU identified CRs

Trending Items
GROUND (ELECTRICAL)
RISK TO GENERATION
Self- Revealing
UNUSUAL EVENT RELATED 6/18/04
□

Entergy	REPORTABILITY	CR-VTY-2004-01989

Reportability Version: 1

Report Number:

Report Code: NOT REPORTABLE

Boilerplate Code: NOT REPORTABLE

Performed By : Hamer,Michael J 06/17/2004 15:28

Reportability Description:

Not reportable - This event does not meet the screening criteria. NNS Equipment.

Entergy	CORRECTIVE ACTION	CR-VTY-2004-01989

CA Number: 1

Group	Name

Assigned By: CRG/CARB/OSRC

Assigned To: Eng SUP EWC EFIN Mgmt

Subassigned To :

Originated By: Pallang,Alexander P 06/18/2004 17:51:47

Performed By:

Subperformed By:

Approved By:

Closed By:

Current Due Date: 07/16/2004 **Initial Due Date:** 07/16/2004

CA Type: CR DISPOSITION

Plant Constraint: 0 NONE

CA Description:

CR Disposition
☐Review Screening Comments on the Assignment Tab
☐
☐The CRG has initially classified this CR as
☐Classification Code - "B"
☐Significance Code - "ACE"
☐
☐Follow the process provided in AP 0009 Appendix J. If during your investigations into this event it is determined that the
☐classification should be changed, contact the CA&A representative for re-consideration by the CRG.
☐
☐Perform Apparent Cause Evaluation. Issue the appropriate CAs (per LI 102)
☐
☐CR Disposition Guidelines: This is only a guide. It is not a substitute for the applicable procedures.
☐
☐All Attachments are to be in PDF format
☐
☐oAttach Apparent Cause Investigation Report
☐oEnsure all Screening Comments have been addressed in the investigation - (CR assignment tab)
☐oDevelop adequate corrective actions and issue CAs. (Due Dates per LI 102 Attachment 9.4)
☐o LT CAs Require Approval from GMPO or Director prior to initiating
☐oAttach completed Apparent Cause Analysis Score Card (Figure 8 AP 0009)
☐oAttach completed VYAPF 0009.02 (CR Trend Input Data Sheet) in accordance with Appendix E.
☐oAttach completed VYAPF 0009.05 (Human Performance Evaluation) if required. Include Cause Dept
☐oAttach completed VYAPF 0009.06 (Equipment Failure Evaluation Checklist) if equipment failure involved.
☐oEnter any references needed and enter into Ref. Items.

Response:

Subresponse :

Closure Comments:

Entergy	CONDITION REPORT	CR-VTY-2004-01989

Originator: Bacala,Glenn J
Originator Group: Operations Staff
Supervisor Name: Amirault,Laurence P
Discovered Date: 06/17/2004 08:10

Originator Phone: 2577711
Operability Required: Y
Reportability Required: Y
Initiated Date: 06/17/2004 08:23

Condition Description:
Generator Ground

At 06:53 Annunicator 7-A-2 (Gen Gnd Current Hi) came in.

Immediate Action Description:
Checked the Multifunction relay in the back panels and discovered "Target #2 Neutral Overvolt" alarm locked in. Also discovered the 59/N mechanical target flagged. Contacted ISO and VELCO nothing on grid could be attributed to this event. ERFIS points G036 (ground fault neutral voltage) rose from a value of 2.9V to 138V and G003 (Generator field volts rose from a value of 280V to about 290V. The ground fault voltage remained high for 1 minute. Alarm was reset after about five minutes. Contacted S Gunnip, system engineering, Ops Mgr and General manager

Suggested Action Description:
Contine investigation into this event to determine and correct cause

EQUIPMENT:

Tag Name	Tag Suffix Name	Component Code	Process System Code
22KV	EQUIPMENT		22KV

REFERENCE ITEMS:

Type Code	Description
CR	2004-2015

TRENDING (For Reference Purposes Only):

Trend Type	Trend Code
KEY WORDS	KW-RISK TO GENERATION
KEY WORDS	KW-GROUND (ELECTRICAL)
KEY WORDS	KW-UNUSUAL EVENT RELATED 6/18/04
HOW IDENTIFIED	HI-SELF-REVEALING

Entergy	OPERABILITY	CR-VTY-2004-01989

OperabilityVersion: 1

Operability Code: NOT REQUIRED

Immediate Report Code: NOT REPORTABLE

Performed By: Doane,Lawrence E 06/17/2004 09:19

Approved By: Doane,Lawrence E 06/17/2004 09:20

Operability Description:

The component and equipment it protects is NNS. Additionally, the protective relaying and alarms functioned as required. If further investigation reveals a protective relaying malfunction occured, then this Operability Desc will require revision.

Approval Comments:

Entergy	ASSIGNMENTS	CR-VTY-2004-01989

Version: 1

Significance Code: B - ACE

Classification Code: B

Owner Group: Eng SUP EWC EFIN Mgmt

Performed By: Pallang,Alexander P 06/18/2004 17:48

Assignment Description:

Screening Data
□Significance:□B - ACE
□Owner :□Eng SUP EWC EFIN Mgmt
□Presented By:□Harms, Ed
Comments:□Reference CR 2004-2015
□
A Human Performance Evaluation VYAPF 0009.05 is required for all HU identified CRs

Trending Items
GROUND (ELECTRICAL)
RISK TO GENERATION
Self- Revealing
UNUSUAL EVENT RELATED 6/18/04
□

Entergy	CORRECTIVE ACTION	CR-VTY-2004-01989

CA Number: 1

Group	Name

Assigned By: CRG/CARB/OSRC

Assigned To: Eng SUP EWC EFIN Mgmt

Subassigned To :

Originated By: Pallang,Alexander P 06/18/2004 17:51:47

Performed By:

Subperformed By:

Approved By:

Closed By:

Current Due Date: 07/16/2004 **Initial Due Date:** 07/16/2004

CA Type: CR DISPOSITION

Plant Constraint: 0 NONE

CA Description:

CR Disposition
☐Review Screening Comments on the Assignment Tab
☐
☐The CRG has initially classified this CR as
☐Classification Code - "B"
☐Significance Code - "ACE"
☐
☐Follow the process provided in AP 0009 Appendix J. If during your investigations into this event it is determined that the
☐classification should be changed, contact the CA&A representative for re-consideration by the CRG.
☐
☐Perform Apparent Cause Evaluation. Issue the appropriate CAs (per LI 102)
☐
☐CR Disposition Guidelines: This is only a guide. It is not a substitute for the applicable procedures.
☐
☐All Attachments are to be in PDF format
☐
☐oAttach Apparent Cause Investigation Report
☐oEnsure all Screening Comments have been addressed in the investigation - (CR assignment tab)
☐oDevelop adequate corrective actions and issue CAs. (Due Dates per LI 102 Attachment 9.4)
☐o LT CAs Require Approval from GMPO or Director prior to initiating
☐oAttach completed Apparent Cause Analysis Score Card (Figure 8 AP 0009)
☐oAttach completed VYAPF 0009.02 (CR Trend Input Data Sheet) in accordance with Appendix E.
☐oAttach completed VYAPF 0009.05 (Human Performance Evaluation) if required. Include Cause Dept
☐oAttach completed VYAPF 0009.06 (Equipment Failure Evaluation Checklist) if equipment failure involved.
☐oEnter any references needed and enter into Ref. Items.

Response:

Subresponse :

Closure Comments:

Attachment Header

Document Name:

CR-VTY-2004-02015 CA-00001

Document Location

Subresp Description

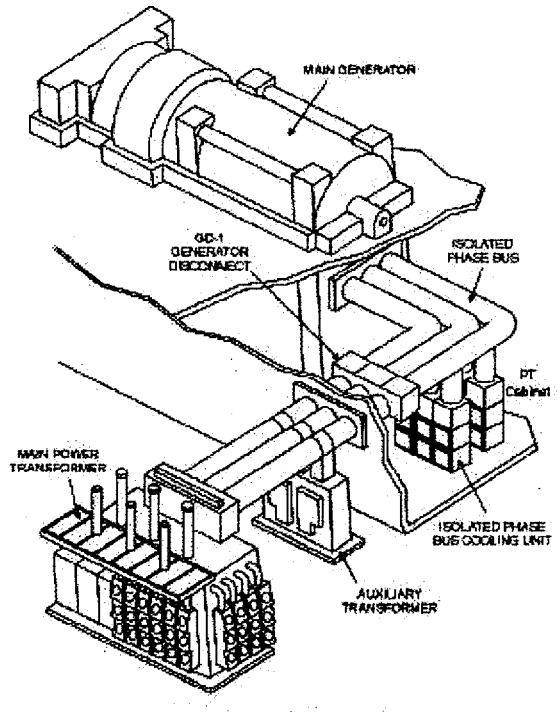
Attach Title:

Attachment 3 - Description of 22 kV Electrical System

ATTACHMENT 3
CR-VTY-2004-2015
Description of the 22 kV Electrical System

The Main Generator electrical output is 22,000 volts (22 kV) and approximately 13,000 amps (at full load). The power is transferred to the Main Transformer, which raises the output voltage to 345 kV, thereby lowering the amperage to approximately 1,000 amps for transmission to the power grid.

Due to the high amperage, it is not desirable to transfer the power from the Main Generator to the Main Transformer using cables. Instead, square conductors fabricated from aluminum stock known as "bus" are used, which have better capability for withstanding the very high currents and the associated high temperatures. The temperatures generated by the high current require forced cooling of the bus. This is accomplished by encapsulating the bus in a duct and forcing cooling air down the duct and around the bus. The cooling air is circulated from a fan and cooler unit down the center run (the "B" phase) of the three phases of ductwork. When the airflow reaches the Main Transformer and Main Generator ends, it is redirected back down the outer two outer phases (the "A" and "C" phases) of ducting to the cooler. The configuration of the busses and ducting is described as "isolated" because each of the three electrical phases has its own bus and ductwork; hence the term "isolated phase bus duct" or "isophase bus duct".



General Isolated Phase Bus Layout

ATTACHMENT 3
CR-VTY-2004-2015
Description of the 22 kV Electrical System

In order to obtain voltage readings from the 22 kV busses for metering and relay purposes, relatively small Potential Transformers (PTs), that lower the voltage to approximately 120 volts, are connected to each phase of the bus. The PTs are protected from high transient overvoltage conditions by surge arresters and capacitors located in the same cabinet as the PTs. This cabinet is referred to as the Generator PT Cabinet. Each of the three phases is enclosed in a compartment within the Generator PT Cabinet.

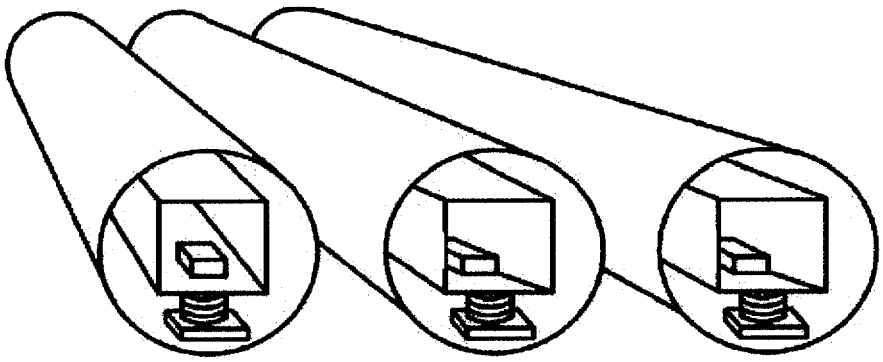
A second transformer, known as the Unit Auxiliary Transformer (UAT) is also powered from the generator output to provide electricity to plant equipment at an output voltage of 4 kV.

A Generator Disconnect Switch (GD-1) is installed in the bus work to allow separating the Main Generator from the Main and Unit Auxiliary Transformers. During plant shutdown conditions, the Generator Disconnect Switch can be opened which allows in-plant electrical loads to be powered from the grid via the Main Transformer and UAT while the Main Generator is isolated for maintenance.

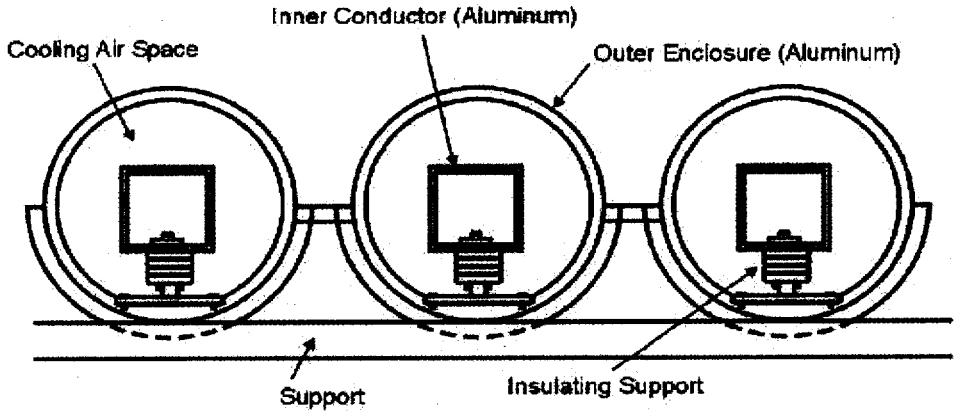
The busses are constructed from aluminum and have a square cross-section that measures 10 inches by 10 inches. The bus duct is constructed of aluminum with an outer diameter of 27.125 inches and a wall thickness of 0.375 inches. The busses are supported within the ductwork at a distance of approximately 6 inches from the bus duct walls by porcelain insulators (known as "standoff insulators").

Schematic diagrams of the bus and bus duct are provided below.

ATTACHMENT 3
CR-VTY-2004-2015
Description of the 22 kV Electrical System



SIMPLIFIED PERSPECTIVE CROSS SECTION



PHASE BUS CROSS SECTION

ATTACHMENT 4
CR-VTY-2004-2015
Damage Assessment of the 22 kV System

Scope of Inspection

The 22KV System isophase bus duct was inspected. The internal portion of the isophase bus duct inside the Turbine Building between the Main Generator and the Turbine Building wall was inspected along with the external portion from the Turbine Building to the Main and Auxiliary Transformers. The Potential Transformer (PT) Cabinets for all three phases and the Generator Disconnect Switch were also inspected.

Inspection Results

The inspection of the portion of the isophase bus duct internal to the Turbine Building determined that the "A" phase ductwork had many broken insulators and was covered in soot between the Generator Disconnect Switch and the Turbine Building wall. The "B" phase ductwork and bus were found to be clean and intact from the isophase bus duct cooling unit to the Turbine Building wall. The "C" phase ductwork was found to have many broken insulators and was covered in soot between the isophase bus duct cooling unit and the Turbine Building wall.

The inspection of the portion of the isophase bus duct external to the Turbine Building determined that the "A" phase ductwork had all insulators broken and was covered internally with soot between the Turbine Building wall and the Main Transformer low voltage bushing box. The "B" phase ductwork and bus was found to be intact internally from the Turbine Building wall to just short of the Main Transformer low voltage bushing box. The "B" phase ductwork had evidence of multiple arc strikes along the bus and the inside of the duct wall. The "C" phase ductwork was found to have all insulators broken and was covered in soot between the Turbine Building Wall and the Main Transformer low voltage bushing box. All three phases had the ductwork deformed or damaged at the Main Transformer low voltage bushing box end due to the fire.

The Generator Disconnect Switch (GD-1) was not damaged.

The "A" phase compartment of the Generator PT Cabinet was observed to have undergone a severe overpressure transient due to the failed surge arrestor. The interior of the "A" phase compartment of the Generator PT Cabinet also had a sooty coating. Internally, the "B" and "C" phase compartment of the Generator PT Cabinet were intact and clean. Some minor material damage occurred in the immediate vicinity external to the Generator PT Cabinet.

ATTACHMENT 5
CR-VTY-2004-2015
Electrical Fault Analysis

The electrical fault that caused the damage at the Main Transformer low voltage bushing box and the "A" phase section of the Generator PT Cabinet started as a single phase-to-ground fault. This was ascertained through analysis of the Beckwith Relay Data (see Attachment 1A – Timeline Figures). The initial indication of the fault was a change in neutral-to-ground voltage. Since the generator is impedance grounded, minimal fault current exists and a voltage drop is created across the neutral grounding impedance (neutral-to-ground voltage).

As can be seen from the neutral-to-ground voltage on the Beckwith Relay Data, a fault to ground occurred and cleared several times in rapid succession. Subsequent analysis of phase-to-ground and neutral-to-ground voltages shows the initial ground faults to be on the "B" phase. On the final fault, a phase-to-phase fault occurred. At this point in time, both the "A" phase voltage and the "B" phase voltage lowered; the "A" phase and "B" phase currents greatly increased and were equal in magnitude and 180 degrees out of phase. The voltage dropped because the system could not maintain the voltage under the fault conditions. The currents in the "A" and "B" phases were equal and 180 degrees out of phase because the current in the "A" and "B" phases is the fault current and the current transformers in the phases are reversed with respect to the fault current flow.

Subsequent analysis of the phase-to-ground voltages showed that the initial ground faults occurred on the "B" phase, and that a second fault (causing a phase-to-phase fault) occurred on the "A" phase.

It is almost certain that this was not a direct phase-to-phase fault, but that the "A" and "B" phases faulted to ground at different locations. This is based on the following:

- ? The damage in the "A" phase occurred at the Generator PT cabinet, while the damage to the "B" phase occurred in the low voltage bushing box at the Main Transformer
- ? No arc marks exist on the "A" phase at the low voltage bushing box and no arc marks exist on the "B" phase at the Generator PT Cabinet
- ? Arc marks were found at the "B" phase of the low voltage bushing box, both on the bushing (energized) and the box (grounded) indicating current flow phase-to-ground.

With two phases faulted to ground, destructive current could flow regardless of the neutral grounding impedance. The path of the destructive current is from one grounded phase, through ground, to the other grounded phase. Based on the location of the damage found on the "A" and "B" phases, the locations of the ground faults were determined to be the surge cubicle of the Generator PT Cabinet for the "A" phase and the low voltage bushing box at the Main Transformer for the "B" phase.

Based on the lack of arc marks in the "A" phase surge cubicle at the Generator PT Cabinet, and the destruction of the "A" phase surge arrester (connected from phase to ground), the ground fault on the "A" phase was through the surge arrester and was a result of failure of the surge arrester. It is likely this fault was due to marginal material condition of the arrester and increased "A" phase-to-ground voltages due to the arcing ground fault on the "B" phase.

ATTACHMENT 5
CR-VTY-2004-2015
Electrical Fault Analysis

Based on arc marks at the "B" section of the low voltage bushing box, and the lack of internal damage to the "B" phase bushing, the ground fault on the "B" phase was from the top plate of the "B" phase bushing to the front cover of the low voltage bushing box. Since the clearance from the bushing to the cover is more than adequate for the design voltage (including transients), and no abnormal over-voltage condition was noted, the ground fault is due to loose/foreign material bridging the clearance from the bushing to the low voltage bushing box. Evidence of arcing in the "B" phase low voltage bushing box existed on the top plate of the bushing, and on the cover plate of the bushing box. The distance from the arc marks on the cover to the arc marks on the bushing top plate is approximately 18".

The following sketches show the location of the arc marks on the "B" phase bushing. The predominant indication of arcing is labeled "B1", with lesser indications of arcing labeled as "B2" and "B3".

A subsequent fault on the "C" phase occurred. This was also ascertained through analysis of the Beckwith Relay Data. Based on the location of the damage on the "C" phase, the location of the fault was determined to be at the "C" phase of the low voltage bushing box.

This fault is also believed to be a phase-to-ground fault. This is based on the arc mark on the "C" phase bushing (on the side away from the "B" phase) and lack of internal damage on the "C" phase bushing. No corresponding arc marks on the "C" phase low voltage bushing box could be found; however, the majority of the "C" phase low voltage bushing box was destroyed as a result of the fire.

Since the clearance from the bushing to the cover is more than adequate for the design voltage, and no over-voltage condition was noted, the ground fault on the "C" phase could have been initiated by loose/foreign material expelled from the "B" section of the low voltage bushing box, or by a highly ionized atmosphere within the low voltage bushing box itself.

The arc marks found on the low voltage bushings and the low voltage bushing box were as follows:

Three arc marks were found on the "B" phase bushing. Two were pronounced (B1 and B2) and the third (B3) was less pronounced. Arc mark B3 may have been modified by the subsequent fire oriented around the "C" phase bushing box, or it may not be an arc mark, but merely severe localized melting. Spattered metal was found on the mounting flange of the bushing, below the locations of the B1 and B2 arc marks.

One arc mark was found on the "B" phase low voltage bushing box. The mark was on the cover, near the bottom, on the side toward the "A" phase. The point of the arc strike no longer exists (the material was vaporized or melted, leaving a hole), but the surrounding area on the inside of the cover is plated with what appears to be copper (the cover is aluminum). Spatter of what appears to be copper was also found around the middle of the inside of the cover and the area toward the hole in the cover. The side of the "B" phase section of the low voltage bushing box adjacent to the "C" phase was not examined for arc marks as it was essentially destroyed in the subsequent fire.

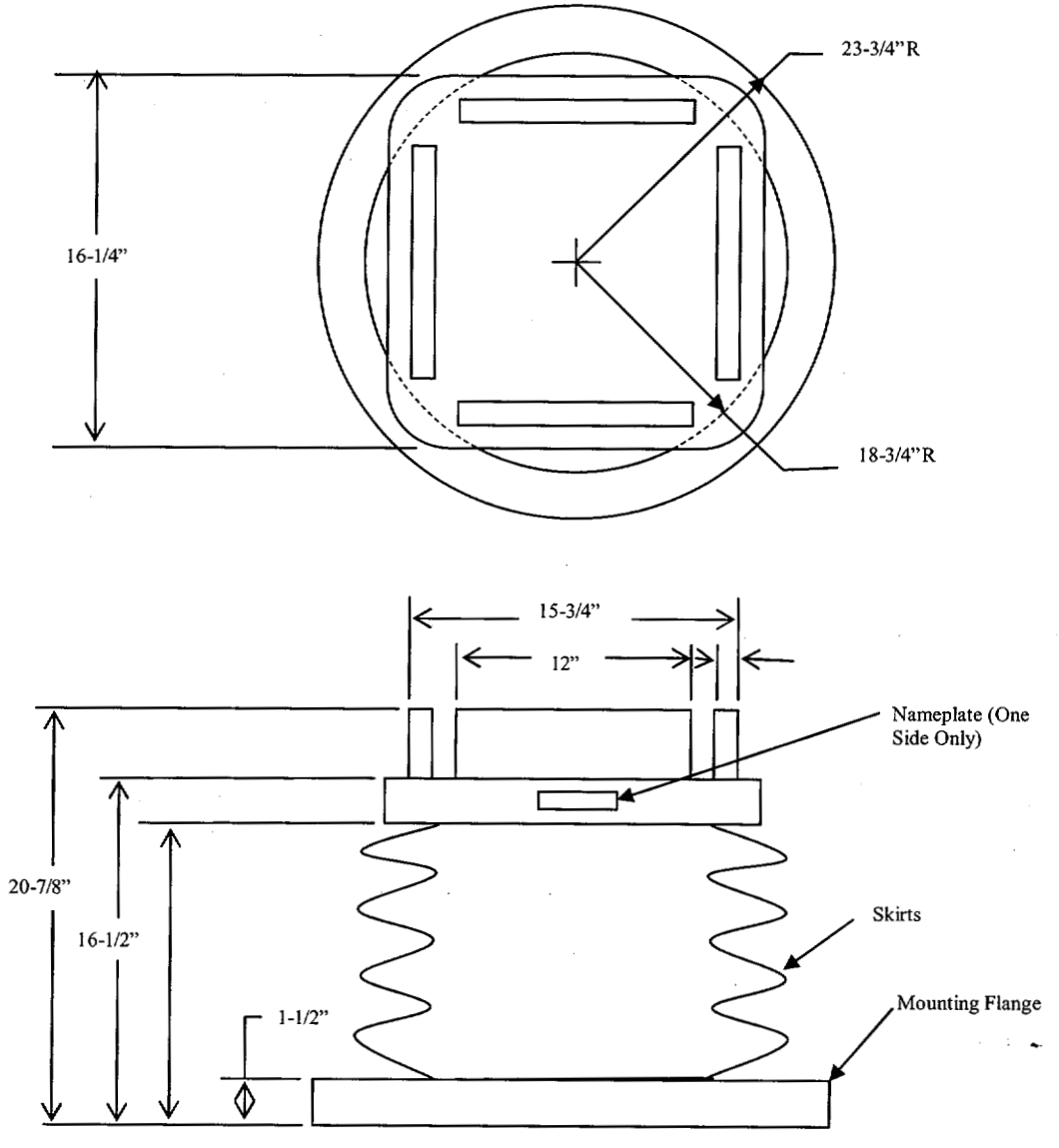
ATTACHMENT 5
CR-VTY-2004-2015
Electrical Fault Analysis

One arc mark (C1) was found on the "C" phase bushing. The "C" phase section of the low voltage bushing box was not examined for arc marks. The C phase section of the low voltage bushing box was essentially destroyed in the subsequent fire.

The approximate distance from the arc mark on the "B" phase section of the low voltage bushing box cover to the nearest arc mark on the "B" phase bushing (B1) is approximately 18".

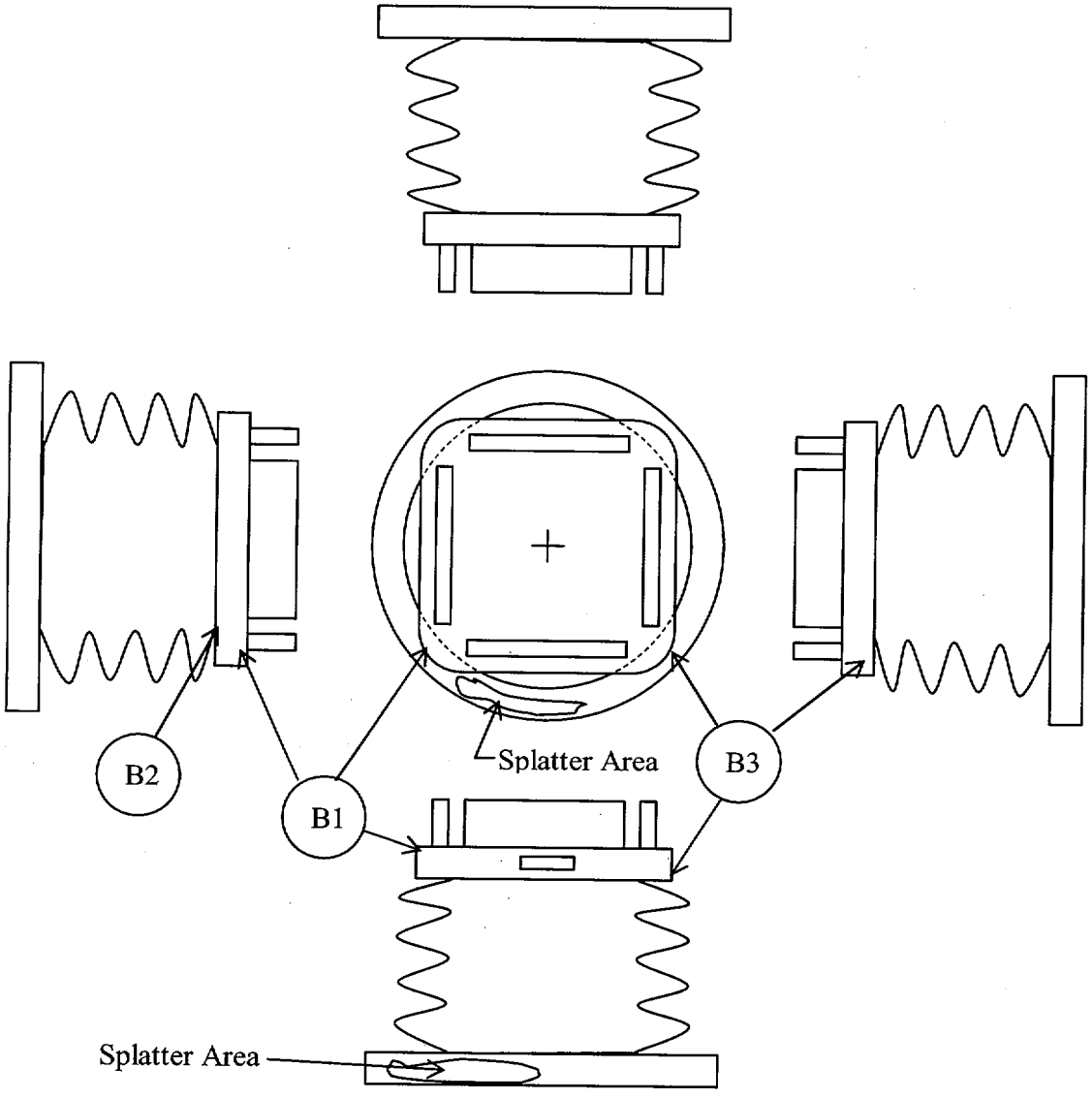
Sketches and some photographs of the arc locations are provided on the following pages.

ATTACHMENT 5
CR-VTY-2004-2015
Electrical Fault Analysis



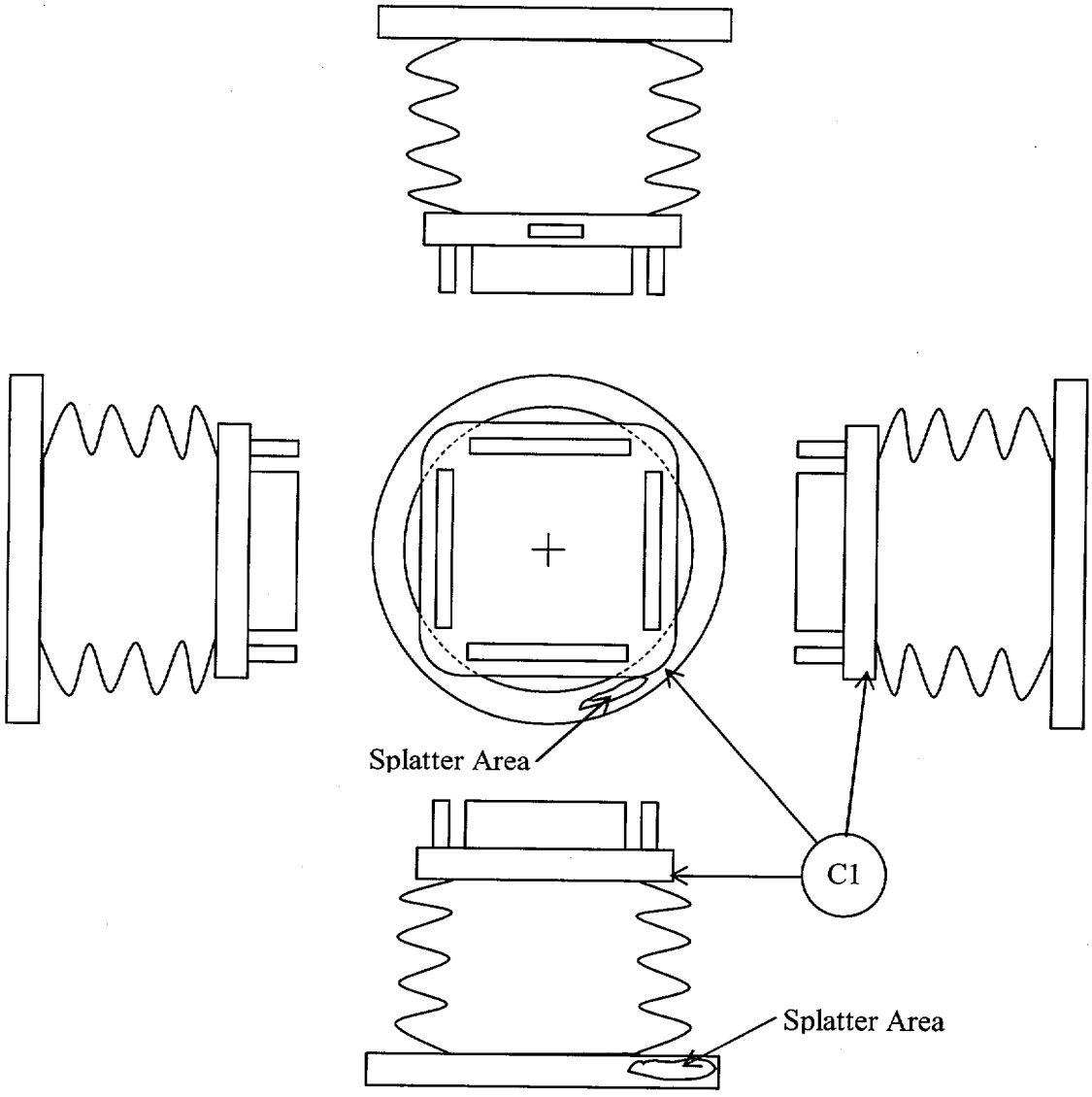
Low Voltage Bushing Dimensions

ATTACHMENT 5
CR-VTY-2004-2015
Electrical Fault Analysis



Side facing bushing box cover

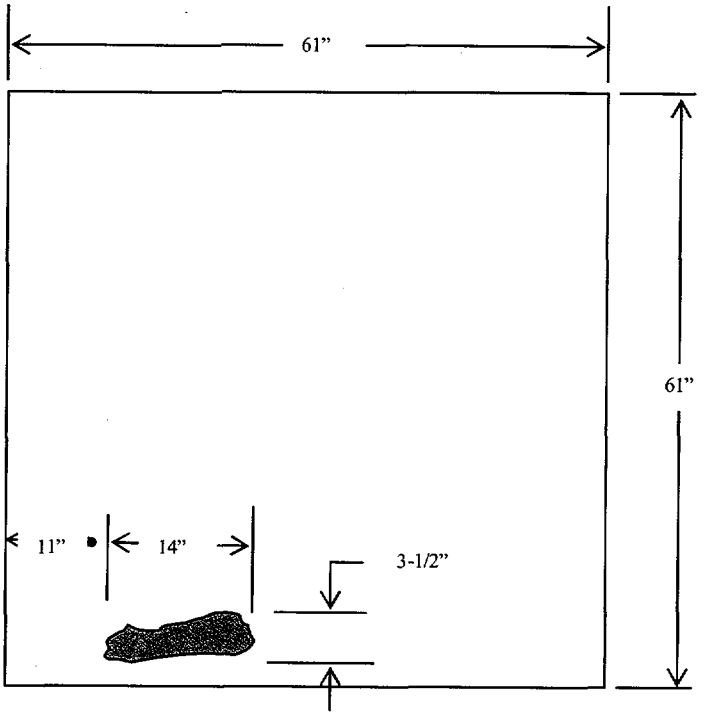
B Phase Low Voltage Bushing



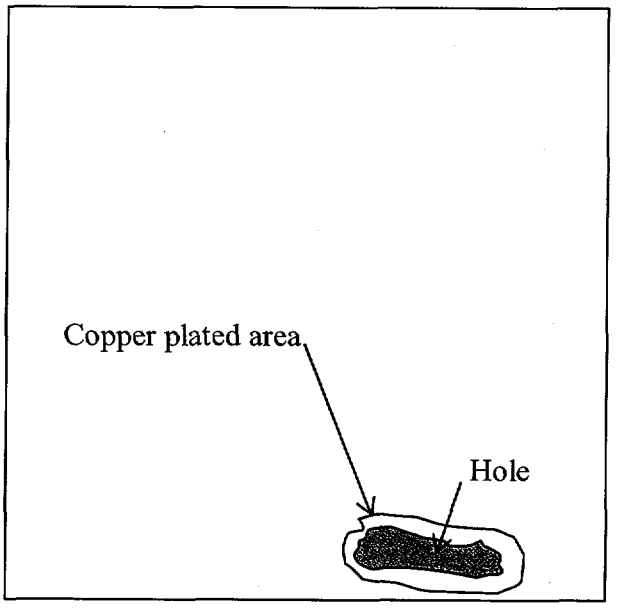
Side facing bushing box cover

C Phase Low Voltage Bushing

ATTACHMENT 5
CR-VTY-2004-2015
Electrical Fault Analysis



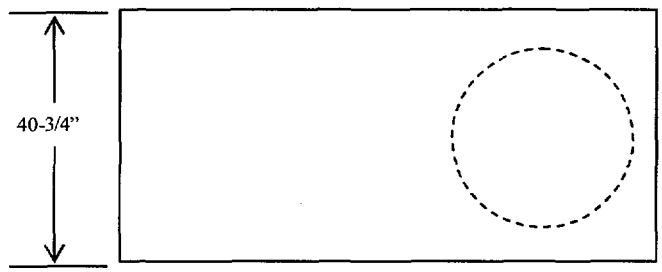
Exterior



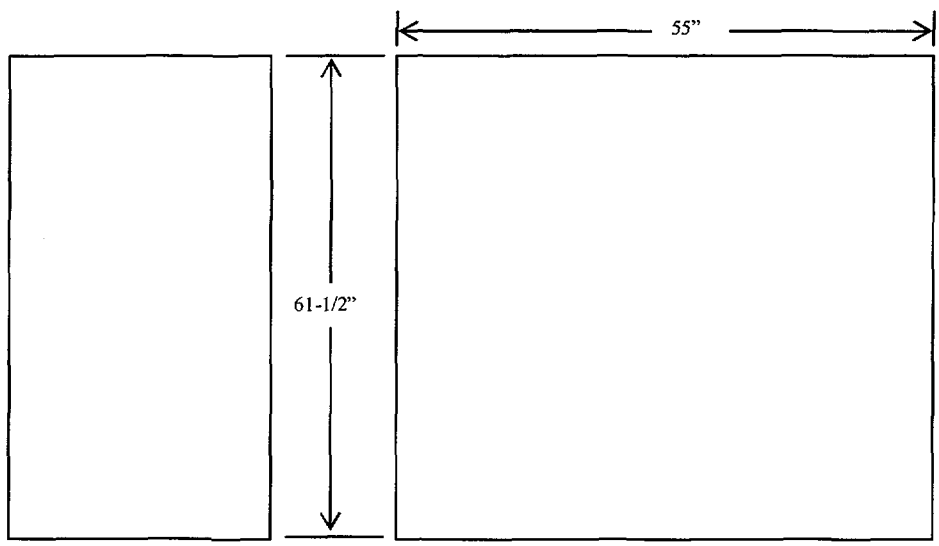
Interior

B Phase Section Bushing Box Cover

ATTACHMENT 5
CR-VTY-2004-2015
Electrical Fault Analysis



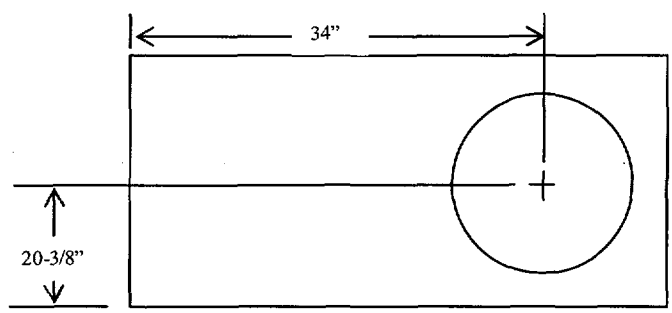
Bird's Eye View



Side View

Front View

Notes:
1. Dimensions are interior dimensions
2. Cover is centered on Box
3. Bushing is centered on circular cutout.

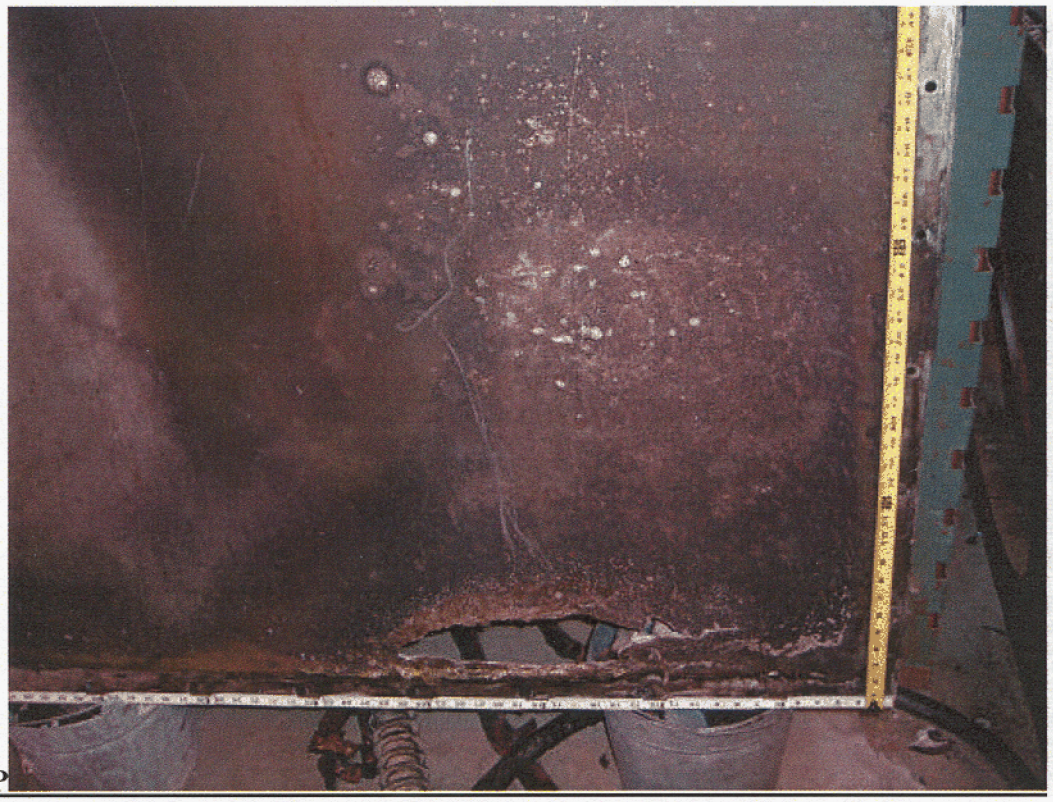


Worm's Eye View

B Phase Section Bushing Box Dimensions

B Phase Bushing Arc Mark

B Phase Bushing Arc Mark Close-up



B P

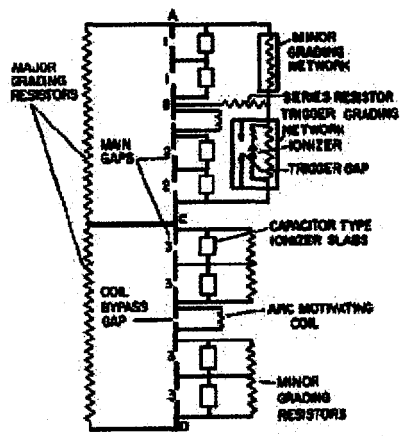
Inside of B Phase Cover

Inside of B Phase Cover Close-up

ATTACHMENT 6
CR-VTY-2004-2015
Equipment Failure Evaluation of the Surge Arrester

According to the label plate on the "B" surge arrester, the failed surge arrester that was installed in the "A" surge cubicle of the Generator Potential Transformer (PT) Cabinet was a General Electric Alugard Model 9L11LAB.

When in service, the surge arrester is exposed to the normal nominal voltage (13 kV) between phase and ground. The arrester operates to discharge a voltage surge to ground by triggering spark jumps across a series-circuit of gaps in a conductor. The circuit is controlled by an arrangement of resistors, capacitors, and coils that provide the appropriate operating characteristics, including interrupting the gap current flow after the voltage lowers. The circuit is shown below.



The surge arrester in the "A" surge cubicle of the Generator PT Cabinet had been in service since the plant was built (approximately 32 years). It was enclosed in a nearly air tight cabinet. No record of failure or replacement of any of the three surge arresters housed within the Generator PT Cabinet has been found.

Industry-recommended preventive maintenance for the component would consist of an inspection and cleaning of the porcelain insulator and Doble testing to determine the condition of the insulation between the conductor and ground. The surge arrester itself was not included in the Vermont Yankee Preventive Maintenance program. The porcelain insulator was cleaned and inspected as part of the preventive maintenance performed on the 22 kV bus. No testing of the surge arresting function has ever been performed.

According to the applicable General Electric instruction manual (GEH-2598B) specified on the label plate: "These arresters do not require testing, and no test which applies power voltage in excess of maximum arrester voltage rating should be made without consulting the General Electric Company. There is no single field test which will indicate the

complete operating characteristics of the arrester." This comment had been interpreted to mean that there is no field test that would determine the surge suppression performance of the arrestor.

The application of this device is described in the instruction manual:

> Arresters are designed to limit surge voltages to a safe value by discharging the surge current to ground, and to interrupt the power –frequency follow current. The ability to interrupt power follow current is limited to applications where the power-frequency voltage at the arrester never exceeds the arrester rating [21 kV].

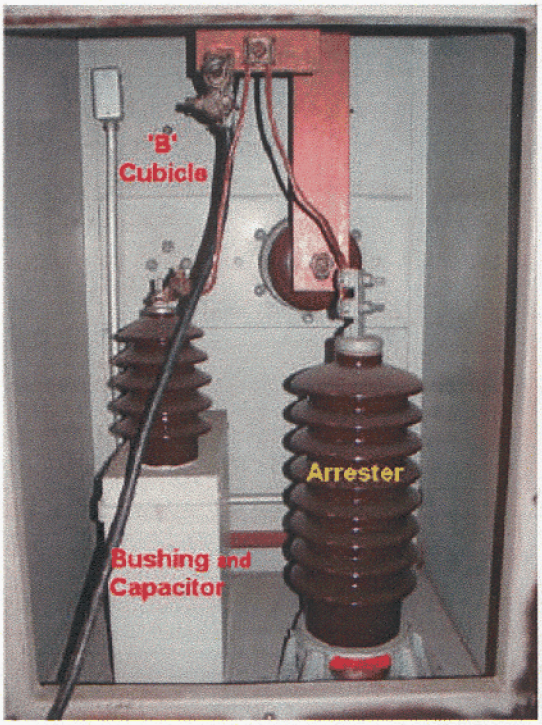
The instruction manual goes on to describe a failure mechanism related to overvoltage conditions:

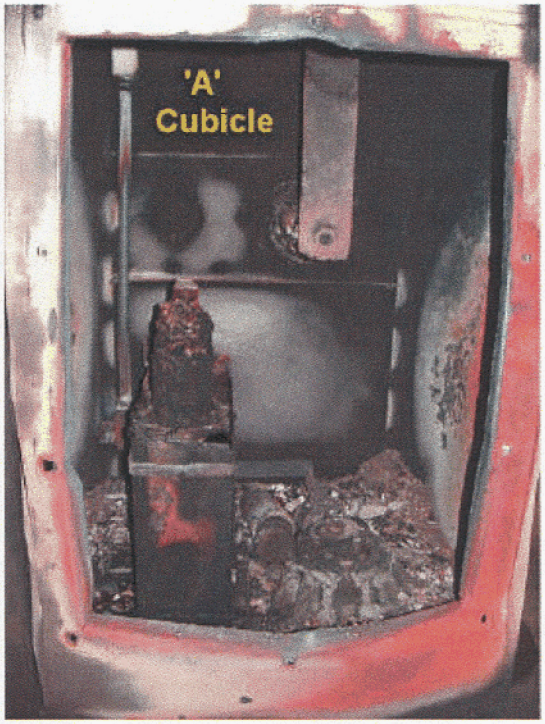
> This arrester may be damaged if the power frequency voltage applied exceeds the arrester rating for even a few cycles after a surge sparks over the gaps. Therefore, it is important to make certain that the system power-frequency voltage from line-to-ground under any condition of switching, fault, or overvoltage, never exceeds the arrester rating.

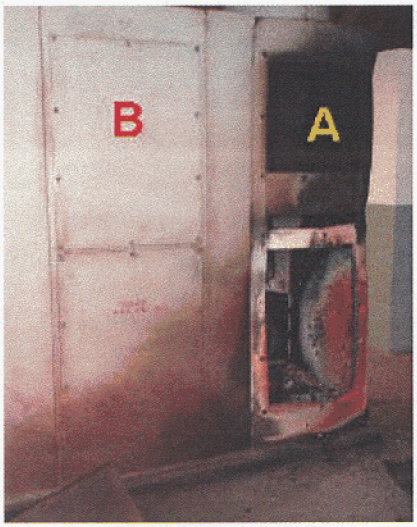
The nameplate rating on this surge arrester is 21 kV. There is no data that establishes a voltage greater than this was imposed on the arrester.

If the arrester had deteriorating internal insulation due to aging or other factors, it could have had significantly reduced current limiting capability. A concurrent fault-to-ground on another phase could cause the arrester to catastrophically fail in a fashion similar to what was observed as a result of this event.

ATTACHMENT 6
CR-VTY-2004-2015
Equipment Failure Evaluation of the Surge Arrester







ATTACHMENT 7
CR-VTY-2004-2015
Failure Analysis of the 22 kV Bus Flexible Connector

The isophase bus is constructed of a square aluminum bus within round ductwork (see Attachment 3 for drawings of the bus). The bus is insulated from the duct by porcelain insulating standoffs, which support the bus within the duct. The bus transfers current from the Main Generator to the Main Transformer. There are flexible connectors located within the isophase bus duct inside the Turbine Building that allow for thermal expansion and contraction of the bus due to heat generated by the current flow through the bus. Two flexible connectors are provided for each phase of the isophase bus. One flexible connector is between the isophase bus duct cooling unit and the Generator Disconnect Switch (GD-1). The other flexible connector is located between GD-1 and the Turbine Building wall.

Each flexible connector is made up of eight lamination assemblies grouped in pairs on each side of the Bus for a total of eight assemblies per connector. Each assembly contains 22 aluminum laminations. Each of the laminates is 20 mils thick. The bus and outer laminations are coated with black paint. The other layers of lamination are unfinished aluminum.

While inspecting the "B" isophase flexible connector removed from the Main Generator end of the bus (inside the Turbine Building), it was noted that one flexible connector outside lamination was missing. The remaining laminations were counted and 21 remained in that assembly. All other laminations in the remaining flexible connectors were found intact.

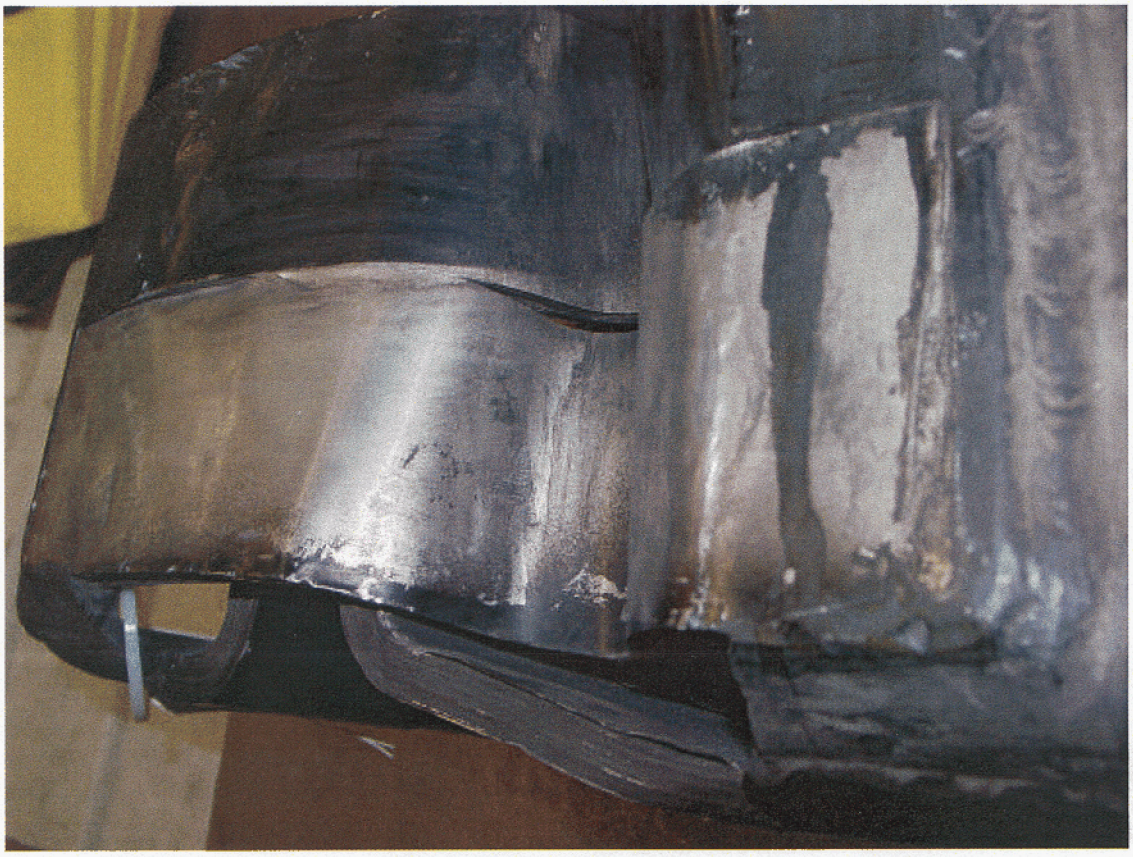
The flexible connectors were visually inspected to determine the cause of the failure of the missing laminate. The report of the failure can be found in Attachment 7A.

The "B" phase flexible connector will be sent to a metallurgical lab for further examination.

Photographs of the flexible connector with the missing laminate follow.

Flexible Connector from the "B" Isophase Bus Cooling Unit end (Missing Lamination)

ATTACHMENT 7
CR-VTY-2004-2015
Failure Analysis of the 22 kV Bus Flexible Connector



Close-up of Missing Lamination

ATTACHMENT 7A
CR-VTY-2004-2015
Examination of Bus Duct Flexible Connectors

MEMORANDUM

Date: June 29, 2004

To: George Thomas

From: Dave King

Subject: Evaluation of Three (3) Iso Phase Bus Flexible Connectors

Background

On June 28, 2004, as part of the failure analysis effort on the Iso Phase Bus failure, George Thomas asked me if I would perform and evaluation of the subject components and report my findings to him as soon as practical. No information was given to me in advance of the evaluation as not to influence my findings. I was asked to perform the evaluation and present my conclusions relative to the findings. This memorandum discusses the method of examination, findings, conclusions and recommendations.

Discussion

Three flexible connectors that were removed from the Iso Phase Bus post event were stored in an isolated/secure area of the CAB. The inspections were conducted within the confines of this area. General visual examinations were conducted to ascertain the overall condition of the components, look for obvious differences and failures. Detailed visual examinations were conducted with a 5X, 10X and 20X eye loupe and a high intensity flashlight.

General Visual Examination Observations

All three components were inspected for obvious structural discontinuities. With the exception of the fact that the components had been cut out of the bus work and had very rough cut ends, none of the components exhibited major structural damage. The obvious difference between the three components was that one had a section of lamina that was not painted. Based on this observation, I elected to do the detailed visual examination of this component first. This component was labeled as the B Phase Flexible Connector.

Detailed Visual Examination

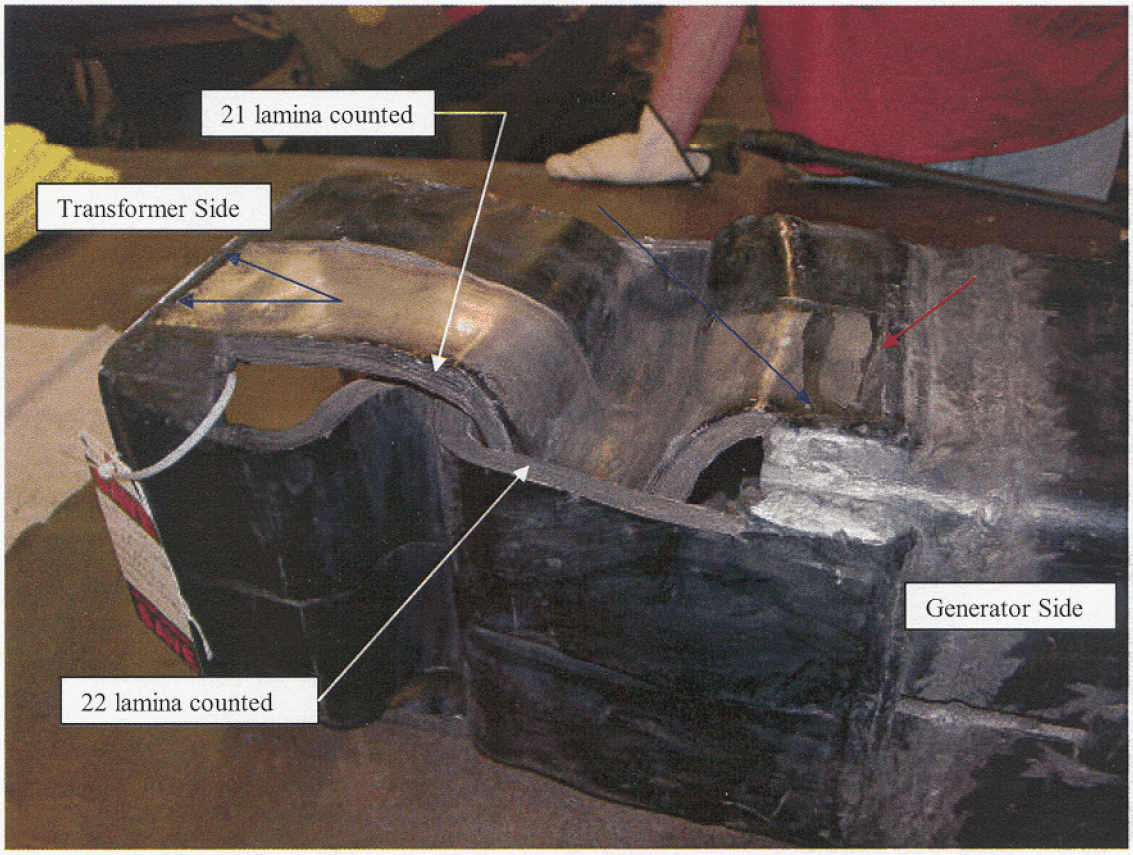
The first question to be answered was, "why was one section of lamina not painted?" There were three possible explanations for this condition. 1. The paint had been removed for some reason relative to the investigation. This explanation was eliminated because George had indicated that the components were removed from the bus work in the "as found condition" and had not been modified in any way. 2. That lamina section had not been painted at original installation. This was unlikely due to the fact that the other components were completely painted. 3. The top lamina that had been painted was missing. This seemed the most likely scenario. Based on that assumption, I began the detailed visual examination in this area.

The first observation that I made in this area was that the fillet weld that attached the lamina to the bus work had been ground flush or nearly flush on all sides with the surface of the existing lamina. This excessively ground condition existed on every section of the B phase flexible connector; however, it was not noted on either the A or C phase flexible connectors except in small random areas. Closer examination on the B phase flexible connector in the suspect area

revealed a small lip at the edge of the fillet. A closer look confirmed that fracture faces existed on three sides of the lamina attachment area. By magnified observation of these fracture surfaces I noted that one surface had a smoother appearance and a layer of oxides or carbon deposits (red arrow in photo below) indicating the possibility of an older failure. This condition extended for approximately 90% to 100% of the end weld length. The other three areas (blue arrows in photo below) had a clean (shiny) grainy appearance indicative of a recent failure.

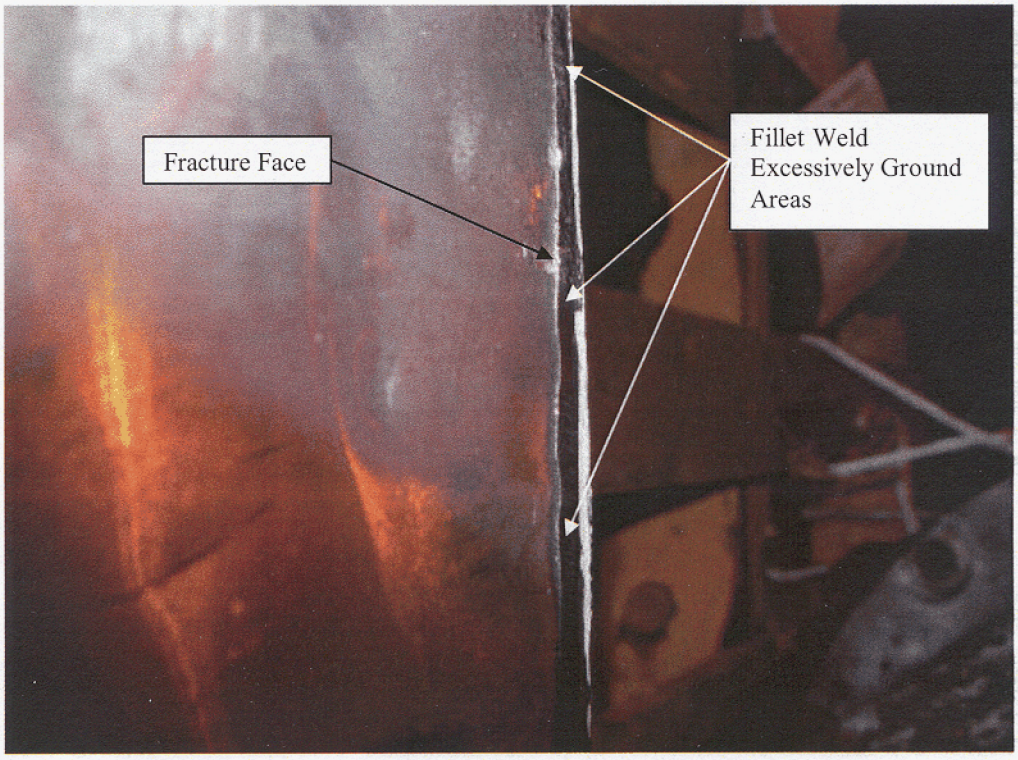
In an effort to determine if a section of lamina had in fact existed in this area, I counted the lamina in the affected section at 21 and 22 in other areas indicating that one lamina sheet was potentially missing.

Following are photographs of interest relative to the fractured areas on the B phase flexible connector:

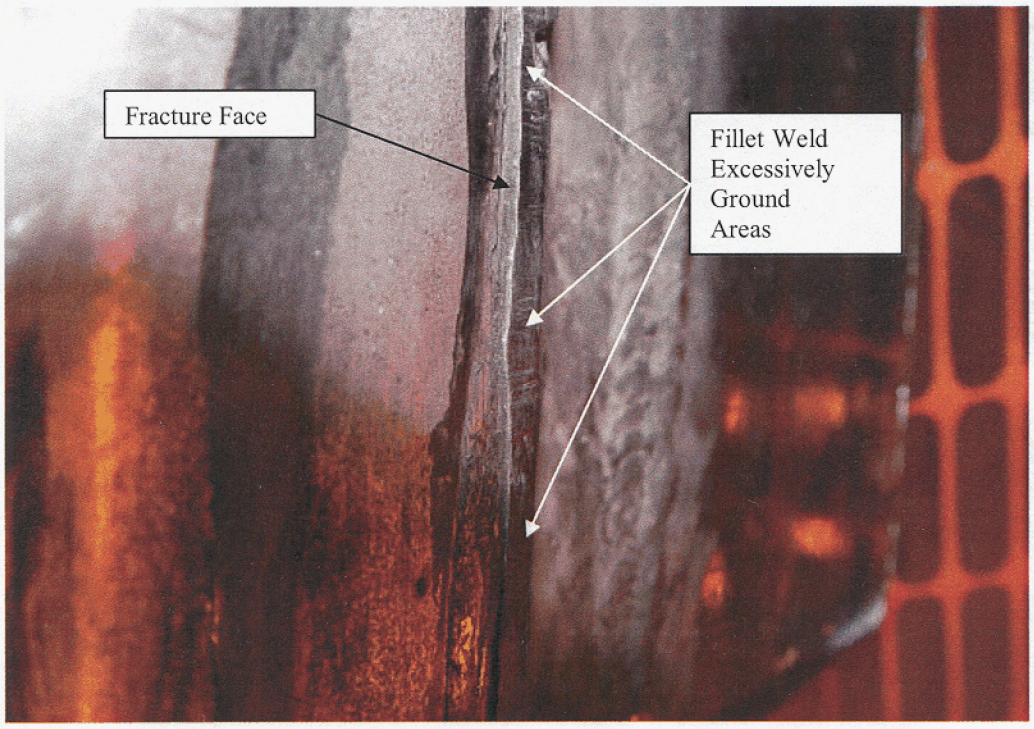


B Phase Flexible Connector Showing Overall View

The following photographs are closer views of the fracture surfaces:
Note: These photographs were taken at a camera to lamina surface angle of approximately 20°-30°.



B Phase Flexible Connector Showing Transformer End Fracture Face (note shiny appearance)



B Phase Flexible Connector Showing Generator End Fracture Face (note dull appearance)

Detailed visual examinations were performed on the lamina welded connections of the remaining segments of the B phase and the other two (2) flexible connectors (A phase and C phase). As stated earlier all of the segments on the B phase flexible connector had been excessively ground. In some cases I believe that this excessive grinding did reduce the thickness of the surface lamina. Further testing will be necessary to confirm this. No evidence of excessive grinding (with the exception of small isolated areas), cracking or de-lamination was observed on the A or C phase flexible connectors. It would appear that the failed location on the B phase connector was an isolated case relative to these three connectors.

Conclusions

It appears to me that the failure of the B phase flexible connector lamina likely occurred as follows:

At initial fabrication, for whatever reason, the lamina attachment welds on the B Phase flexible connector were ground flush or nearly flush with the top surface of the lamina leaving very little weld ligament to retain the lamina sheet.

Over approximately 32 years of thermal cycling the bus work (start-ups, shutdowns, load shifts, etc.) the flexible connectors experienced significant thermal movement. I believe that due to this thermal cycling, the end attachment weld on the B phase flexible connector lamina experienced a low cycle fatigue crack initiation as witnessed by the dull oxide covering on the fracture surface of the generator side end weld. This would be an indication that this weld had cracked at some time in the relatively distant past. Once this low cycle fatigue crack on the end weld had propagated a sufficient distance along the weld to allow the lamina to be lifted into the cooling air flow, the lamina would have most likely began a high cycle vibration due to air flow over the lamina sheet. This high cycle vibration would have then placed additional stresses on already undersized weld ligaments and continued crack propagation. As the crack continued to propagate along the length of the end weld, the sheet lifted and more surface area of the lamina was exposed to cooling air flow. At some point the force exerted by the air flow against/over the ever increasing exposed surface area of the lamina, was great enough to fail the small weld on the side of the lamina allowing it to fully lift, and exposing its full surface area to cooling

air flow. This condition would eventually result in failure of the remaining welds and separation of the lamina from the flexible connector assembly.

It is also important to discuss the importance of the velocity of the cooling air flow. It is my belief that higher flow rates associated with the cooling system modification accelerated the failure timetable for this component. However, I also believe that this failure would have occurred at some time in the future even at the original design flow rates given the minimal amount of weld ligament retaining the top lamina sheet.

If we had been able to access these areas to perform a detailed visual examination during RFO 24, I believe that we would have been able to identify the B phase flexible connector as a candidate for potential failure.

My determination for the root cause of this failure is: the excessive grinding (reinforcement removal) that was performed during original fabrication that allowed a low cycle fatigue crack to initiate in the generator end lamina attachment weld and propagate to the point which ultimately lead to failure and separation of the lamina from the component.

Recommendations

These findings should be confirmed by a qualified and certified metallurgical testing laboratory such as Mass Materials Testing Laboratory.

D. B. King
ISI Coordinator
NDE Level III

ATTACHMENT 8
CR-VTY-2004-2015
Security / Fire Response to the June 18, 2004 Transformer Fire

NOTE: *ALL TIMES AS LISTED IN THIS REPORT ARE BASED ON SECURITY COMPUTER SYSTEM TIMES. THE SECURITY COMPUTERS ARE NOT SYNCHRONIZED WITH THE SYSTEM USED TO DEVELOP THE ROOT CAUSE TIMELINE.*

On 18 Jun 2004, at approximately **0642 hours**, the Wackenhut Security Shift Supervisor (SSS), who was positioned in Gatehouse #2 (in the Gate #2 Watch area), observed a bright flash resonate from the south side of the transformer.

Also at approximately **0642 hours** this date, the ENVY Security Operations Supervisor and the ENVY Security Training Coordinator, both positioned near the dumpster located just outside the stairway leading up to the Security Offices above Stores, heard a loud bang and some buzzing noise emanating from the area of the transformer.

? The above witnessing Security personnel verified at the time of the event that no events from outside the Protected Area fence created the transformer fire.

? Security personnel were directed into heightened awareness by the SSS based on the transformer fire and activities involved with emergency vehicle access to the facility.

A Wackenhut Security Officer who was coming up the south side stairs of Gatehouse #2 observed two hot spots immediately preceding the fire on the transformer.

Approximately **0646 hours** on this date, the SSS observed the 911 emergency line on the SSS phone alarm indicating the Control Room was contacting the 911 Dispatch Center.

At **0649hours** this date, the process for calling in additional Security Officers was initiated to support the fire response at the facility.

At approximately **0652 hours** this date, ENVY Fire Brigade arrived on scene to fight the fire, of which one Security Officer responded to support the Fire Brigade.

At approximately **0657 hours** this date, the Fire Brigade rolled out the Foam Cart to the scene.

At approximately **0705 hours** this date, first offsite fire vehicles from Vernon Volunteer Fire Department arrived at ENVY and entered the Protected Area via the 410 gate, north of Gatehouse #2.

At approximately **0707 hours** this date, the second fire response vehicle from Brattleboro Fire arrived in the Protected Area, immediately followed by another Vernon Volunteer Fire Truck.

ATTACHMENT 8
CR-VTY-2004-2015
Security / Fire Response to the June 18, 2004 Transformer Fire

At approximately **0715 hours** this date, Rescue, Inc. ambulance arrived in the Protected Area to stand-by if needed.

Immediately after the above vehicles entered the Protected Area, the Fire Chief from the Brattleboro Fire Department entered the Protected Area with his Fire Command Vehicle and initiated the on-scene Command Post.

Fire was determined under control (not out) at approximately **0720 hours** this date.

Additional Fire Fighters from the various responding agencies were brought onsite to assist with fire fighting at approximately **0726 hours** this date.

Follow-on fire vehicles from Vernon and Guilford Volunteer Fire Departments were staged outside the Protected Area near the 410 Gate in case the need arose for additional vehicles.

Additional responding fire trucks from Brattleboro, Bernardston, Northfield, and Guilford Volunteer Fire Departments were staged at the Vernon Elementary School.

At approximately **0805 hours** this date, the Fire Brigade deployed a containment sock around transformer.

At approximately **0830 hours** this date, the fire at the Main Transformer was declared out, and re-flash watches were posted.

At approximately **0940 hours** this date, a report over the Gaitronics of a second fire interior to the building in the vicinity of the isophase bus duct cooling unit was announced over the Gaitronics. The Fire Brigade responded. The fire was declared out at approximately **0952 hours** this date.

Both fires have been extinguished, and Security Officers were posted at the transformer and in the Turbine Bay to secure the scenes for evidence preservation at approximately **1000 hours** this date.

At approximately **1017 hours** this date, Vernon Volunteer and Brattleboro Fire Department vehicles left the Protected Area. Rescue, Inc. left the Protected Area at approximately **1025 hours** this date.

ATTACHMENT 8
CR-VTY-2004-2015
Security / Fire Response to the June 18, 2004 Transformer Fire

NOTE: In reviewing the information as it was being developed, viewing the scene of both the fire at the Main Transformer and damage at the Generator PT Cabinet immediately after fires were extinguished, and looking at the material evidence that was recovered from these areas, there appears to be no indications that a malicious intentional act by individual(s) was involved as a cause of the event.

ATTACHMENT 9
CR-VTY-2004-2015
Results of Fire Investigation

Introduction

The purpose of this attachment is to describe the fire investigation related to the fire that occurred at the Main Transformer at the Vermont Yankee Nuclear Plant on June 18, 2004. A fire occurred at the plant Main Transformer located outside the Turbine Building. At approximately the same time, an intense electrical flash occurred at the Generator PT Cabinet located at the Main Generator end of the isophase bus. Both the flash and fire appear to be related to the same electrical event. No information has been found to suggest that either event was intentional or the result of a deliberate act.

Fire Investigation

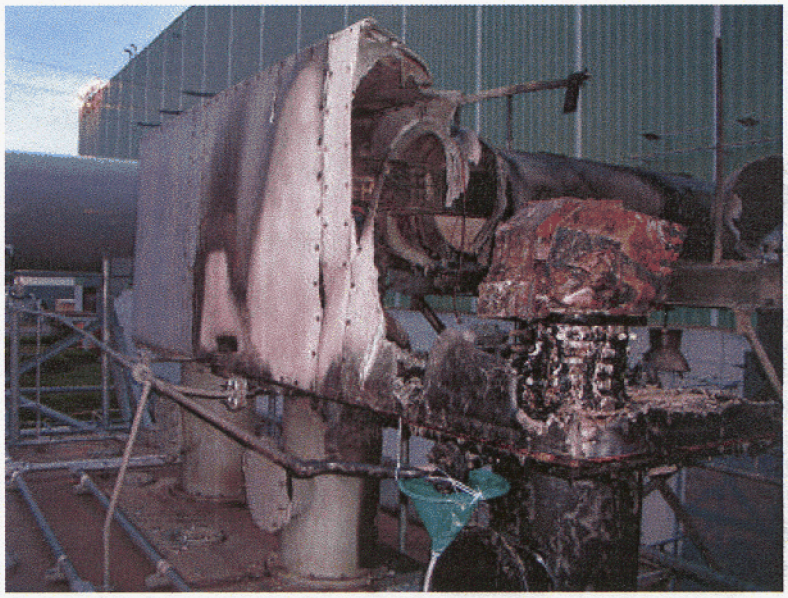
The fire investigation began by examining the area around the Main Transformer.

Photograph : Fire 0130

No evidence was found to suggest that the fire started around the base of the Main Transformer. Melted metal and burned artifacts were found around the base of the Main Transformer. These components appeared to come from the top area of the Main Transformer in the area of the fire. Most of the metal remains appeared to be just melted masses of aluminum from the secondary bushing enclosure. Aluminum will melt at 1200 degrees Fahrenheit. Deformed aluminum is typically the result of an impinging flame and radiant heat from an oil fire.

ATTACHMENT 9
CR-VTY-2004-2015
Results of Fire Investigation

A close examination of the fire area witnessed at the Main Transformer was conducted. The fire damage appeared to be at the top area of the Main Transformer in proximity to the secondary "C" phase area.



Photograph : T-1-1A ABB 31

The fuel for this fire was essentially the transformer oil. The oil sprayed from an oil pipe flange system located in front of the "C" phase bushing. Burn patterns in the area of the subject flange supported the opinion that the fire was fueled by oil from the flange area. No information was found during repair to suggest another source of fuel for this fire.

An examination of the Main Transformer "C" turret vent line flange system was conducted. The flange system consisted of two flanges welded to sections of pipe. The flanges were bolted together with metal screws. The flanges were isolated from each other with plastic sleeves and plastic washers. The initial examination of the flanges identified that one area of the flange system appeared to have separated. This separation would have provided the breach in the system for the oil to spray out from between the pipe flanges. As the oil sprayed out of the flange it was able to make contact with a surface hot enough to ignite the oil and allow it to freely burn. This flange was found to still be leaking after the fire event. The most-likely sources of ignition for the oil would be molten metal created from the electrical arcing in the Main Transformer secondary side enclosure. Another source of ignition may have been any electrical arcing activity that may have been occurring while the oil was leaking.

How the flange was able to fail has not been confirmed. It is suspected that any abrupt movement and/or heat created during the electrical fault event may have damaged the integrity of the flange and allowed the transformer oil to be released.

ATTACHMENT 9
CR-VTY-2004-2015
Results of Fire Investigation

An examination of the bushing area vent piping identified adequate support for the A and B phases and the need for additional support for the C phase vent line. The lack of support on the C phase vent line would amplify any abrupt movement of the piping.

A close examination of the gasket that was a part of the flange appeared to only be damaged in one area of it. The gasket was stained at approximately 25 percent of the total area. This further supports that oil was spraying out of the flange at one specific area. One area of the outer edge of the gasket appeared to be separated. It is suspected that this may be further evidence of oil flow from the flange system during the fire event. More information may be gained through additional examination of the gasket material.

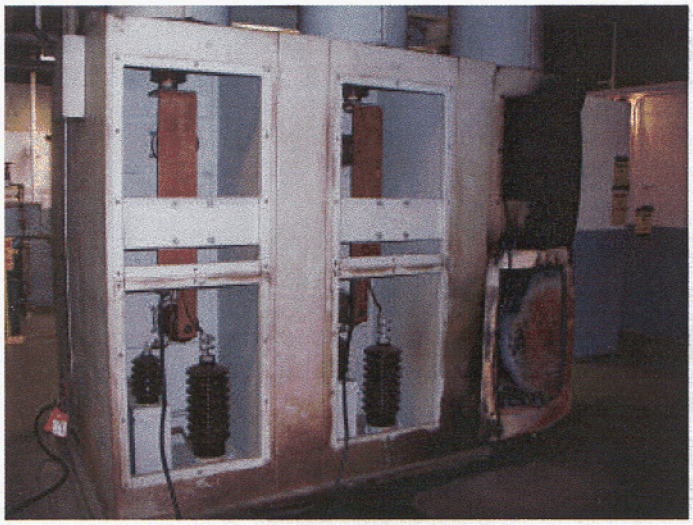
Based on the above evidence, it can be concluded that the fire at the transformer initiated following, and as a consequence of, the electrical fault.

At least two people clearly witnessed the fire. In the interviews it was identified that at buzzing sound was heard prior to the fire. This sound was believed to be electrical arcing activity and confirms the above conclusion.

Examination of the photographs taken of the fire identified that the fire was a bright orange color. The smoke from the fire was a thick, dark, and black. The photographs support the opinion that the fuel for this fire was transformer oil. This is because transformer oil will produce black smoke and an orange flame. Further, the photographs document that the fire was primarily around the C phase bushing.

ATTACHMENT 9
CR-VTY-2004-2015
Results of Fire Investigation

An examination of the Generator PT Cabinet and associated surge cubicle below the turbine floor was also conducted.



Photograph : Surge Cubicle 11

No information was found to suggest that a fire had started outside of the Generator PT Cabinet. Further, no evidence was found to suggest that the electrical flash on the "A" phase surge arrester was started by a fire outside of the "A" phase surge cubicle. The electrical flash damage appeared to have been contained in the compartment.

ATTACHMENT 9
CR-VTY-2004-2015
Results of Fire Investigation

Photograph : Surge Cubicle 01

There was severe damage found in the "A" phase surge cubicle of the Generator PT Cabinet containing the associated surge arrester and capacitor. The surge arrester appeared to have catastrophically failed. The porcelain surge arrester was completely destroyed. More information may be gained by further examining the components removed from the compartment.

ATTACHMENT 10
CR-VTY-2004-2015
INDUSTRY OPERATING EXPERIENCE

OE No	Date	Unit	Title	Description	Applicability
OE 18095	03/22/2004	Clinton	Unit Shutdown Due to a Ground in the Isolated Phase Bus Duct	A unit trip occurred due to a phase to ground fault that occurred in the B-phase of the iso-phase bus. Two possible causes were identified. The first was a test lead for the Partial Discharge Analyzer. The 2nd cause is a damaged flexible link. One of the laminations broke off and traveled down a portion of the iso-phase bus until it came to rest against a bushing. Minor pinpoint arcing was noted. It is also possible that both of these causes were impacted by the increased iso-phase cooling flows that resulted from fan replacements. The flow rates were changed from 23K scfm to 33K scfm.	This event may be applicable to the VY June 18, 2004 event because VY increased the flow on the iso-phase cooling system prior to the failure (within 40 days) and a section of lamination was found in the "B" iso-phase duct.
OE 18112	02/28/2004	Palo Verde	Manual Generator Trip due to Broken Iso-phase Flexible Link Connector	Palo Verde Unit 3 was manually tripped based on indications of a ground fault between the main generator and GSU. The problem was traced to a broken outer copper layer of flexible link, which connects the iso-phase bus to the generator. The broken link was still connected at one end but the free end was making contact with the iso-phase duct causing a ground.	This event may be applicable to the VY June 18, 2004 event because Palo Verde used a similar flexible link design to connect the generator to the iso-phase bus as Vermont Yankee used to connect the main transformer to the iso-phase bus.

ATTACHMENT 10
CR-VTY-2004-2015
INDUSTRY OPERATING EXPERIENCE

OE No	Date	Unit	Title	Description	Applicability
LER 89-017	10/09/1989	Shearon-Harris	Electrical Fault on Main Generator Output Bus Causing Plant Trip and Fire Damage in Turbine Building	A generator and main power transformer phase differential relay tripped the lockout relay of the main generator. Lockout was caused by multiple ground faults. The ground faults destroyed the neutral grounding bus and caused three fires. The initiator of the ground faults has been identified as aluminum debris in the isolated phase bus duct, which was deposited in the bus duct from previous failures of the duct cooling system dampers. Arcing from the aluminum debris in the bus led to a double phase to ground fault at the "B" main power transformer. Magnetic forces from this fault broke insulators in "A" phase and "B" phase of the iso phase bus duct. The "A" phase conductor contacted the bus enclosure creating another ground fault. These faults elevated the voltage at the generator neutral grounding transformer cubicle.	This event is applicable to the VY June 18, 2004 event because numerous arc strike marks were found on the "B" iso-phase bus and bus duct. These strike marks indicated the present of foreign material in the iso-phase duct.
OE 15210	10/19/2002	ANO Unit 1	Mechanical Fatigue Failure Cracking Discovered in Main Generator Flexible Links	During the recent Unit 1 refueling outage, a crack was discovered on one of the flexible links that connected each of the main turbine generator electrical phases to their respective connection points on the iso phase bus. These aluminum flexible links are no longer being used in the industry because of fatiguing problems. Additional flexible links that are located 5-10 feet further down the iso-phase bus were also inspected for cracking .These links were found to have no damage because they were not exposed to the same level of generator vibration.	This event may be applicable to the VY June 18, 2004 event because ANO used a similar flexible link design to connect the generator to the iso-phase bus.
OE 16933	10/09/2003	Perry	Degraded Iso-phase Bus Duct Expansion Joint	Routine thermography survey of the iso-phase ducts (the outer aluminum enclosure not the conductor) revealed degradation of the expansion joints. Cracks were found in the outer layer of the joint. Cracks were noted on the A & C phases in the outer layer of the joint.	This event is not applicable to the VY June 18, 2004 event. The expansion joints were part of the duct itself not the conducting bus.
OE 08885	03/11/1998	St. Lucie 2	Hotspot on Iso-phase Bus	A hot spot was identified on the iso-phase bus at an expansion joint. The hot spot was the result of bolts which had become loose from thermal cycling.	This event is not applicable to the VY June 18, 2004 event. The expansion joints were part of the duct itself not the conducting bus.

ATTACHMENT 10
CR-VTY-2004-2015
INDUSTRY OPERATING EXPERIENCE

OE No	Date	Unit	Title	Description	Applicability
OE 08659	03/19/1997	Calvert Cliffs 2	Flexible Links Cracked on Iso-phase Bus	Cracked lamination on two phases, which connect the output of the generator to the iso-phase bus were noted. Cause of failure was attributed to poor strength material (copper). Analysis found that some of the links were prone to excitation in the 30 Hz range (1800 rpm).	This event is not applicable to the VY June 18, 2004 event. The flexible links being discussed in this OE are of a different physical design and length than those used by Delta-UniBus for expansion links at VY.
OE 14335	06/10/2002	Palisades	Loss of 345kV Bus Due to Failed Lightning Arrester on Startup Transformer	Start-up transformer Y-phase lightning arrester failed, which resulted in the loss of the start-up transformer and its associated 345kV buses. AC leakage testing found the the arrestor was degraded. It was determined that the protective capabilities of Silicon Carbine Arrestors decline over time.	This event may be applicable to the VY June 18, 2004 event since the VY generator surge arresters have been in service for over 30 years have not been tested since they were placed into service.
OE14399	09/24/2001	Salem Unit 1	Switchyard Electrical Fault Results in Manual Reactor Scram	The Salem control room initiated a manual reactor scram because of increasing main condenser back pressure. The loss of vacuum was due to a fault on one of the station power transformer because of the failure of one of its surge arrester. The surge assesstor failure caused an electrical fault and transformer loss. The failed arrester had been in service of of 26 years and vendor (OEM) recommended replacing arresters which had been in service over 20 years.	This event may be applicable to the VY June 18, 2004 event since the VY generator surge arresters have been in service for over 30 years have not been tested since they were placed into service.
EO 10790	08/24/1999	South Texas	Loss of Power to Standby Transformer 2 Due to an Electrical Fault	South Texas experienced a partial loss of off-site power caused by failure of a surge arrester of the Standby Transformer. The failed arrester result in a phase to ground fault. The arrester failure was caused by a internal arrester fault due to a degradation, which went unidentified during periodic testing. This arrester was tested in April 1994 and November 1998. The test identified 500% increase in watts loss, but the component was still within an acceptable range and was returned to service.	This event may be applicable to the VY June 18, 2004 event since the VY generator surge arresters have been in service for over 30 years have not been tested since they were placed into service.

ATTACHMENT 11

Electrical Grid Conditions PriorTo Event

Thomas, George

From: Bonner, John
Sent: Tuesday, June 22, 2004 5:41 PM
To: Amidon, Doug; Johnson, Paul
Cc: Thomas, George
Subject: FW: June 18 Vermont Yankee Trip


NIUT04D5.pdf (34 KB)


06_18_2004_VY.doc (45 KB)

Attached is an email from ISO-NE on system disturbances prior to the VY trip.

John
-----Original Message-----
From: Bertagnolli, Dave [mailto:dbert@iso-ne.com]
Sent: Tuesday, June 22, 2004 5:05 PM
To: Bonner, John
Subject: FW: June 18 Vermont Yankee Trip

John,

Attached are the plots of data captured at the Dynamic Swing Recording devices at Northfield, MA and three other locations in New England during the Vermont Yankee event on 6/18/04. Only one other event occured on the morning of 6/18/04 which was at 01:40 hr and appears to be the trip of a large generator far from the NY/NE area. The NYISO reported that there was a lightning strike at 19:00 hr on 6/17/04 near the Pleasant Valley substation in Southeastern New York. No other trip/reclosings or lightning strikes were reported before the Vermont Yankee event.

Please let me know if you would like more info.

Dave Bertagnolli
ISO-New England

> -----Original Message-----
> From: Luo, Xiaochuan
> Sent: Tuesday, June 22, 2004 03:54 PM
> To: Bertagnolli, Dave
> Cc: Upadhye, Aditya; Kowalski, Richard; Litvinov, Eugene
> Subject: June 18 Vermont Yankee Trip
>
> Dave:
>
> Per your request, Aditya and I have checked the recorders in New
> England for the Vermont Yankee trip at 06:41 hr on June 18.
>
> From the data at Northfield (the PDF file), we can see that the
> voltage at Northfield dropped from 355 kV to 346 kV. Lowest
> frequency at Northfield went to 59.94 Hz. The MW flow on 312 (from
> Northfield to Berkshire) changed by about 220 MW (+130 MW to -90 MW);
> The MW flow on line 381 (Northfield to Vermont Yankee) changed by
> about 300 MW (from -170 MW to
> +130 MW).
>
> The word document shows the frequency trace at three IEDs (Millbury,
> Sherman Road and Pequonnock).

ATTACHMENT 11

Electrical Grid Conditions PriorTo Event

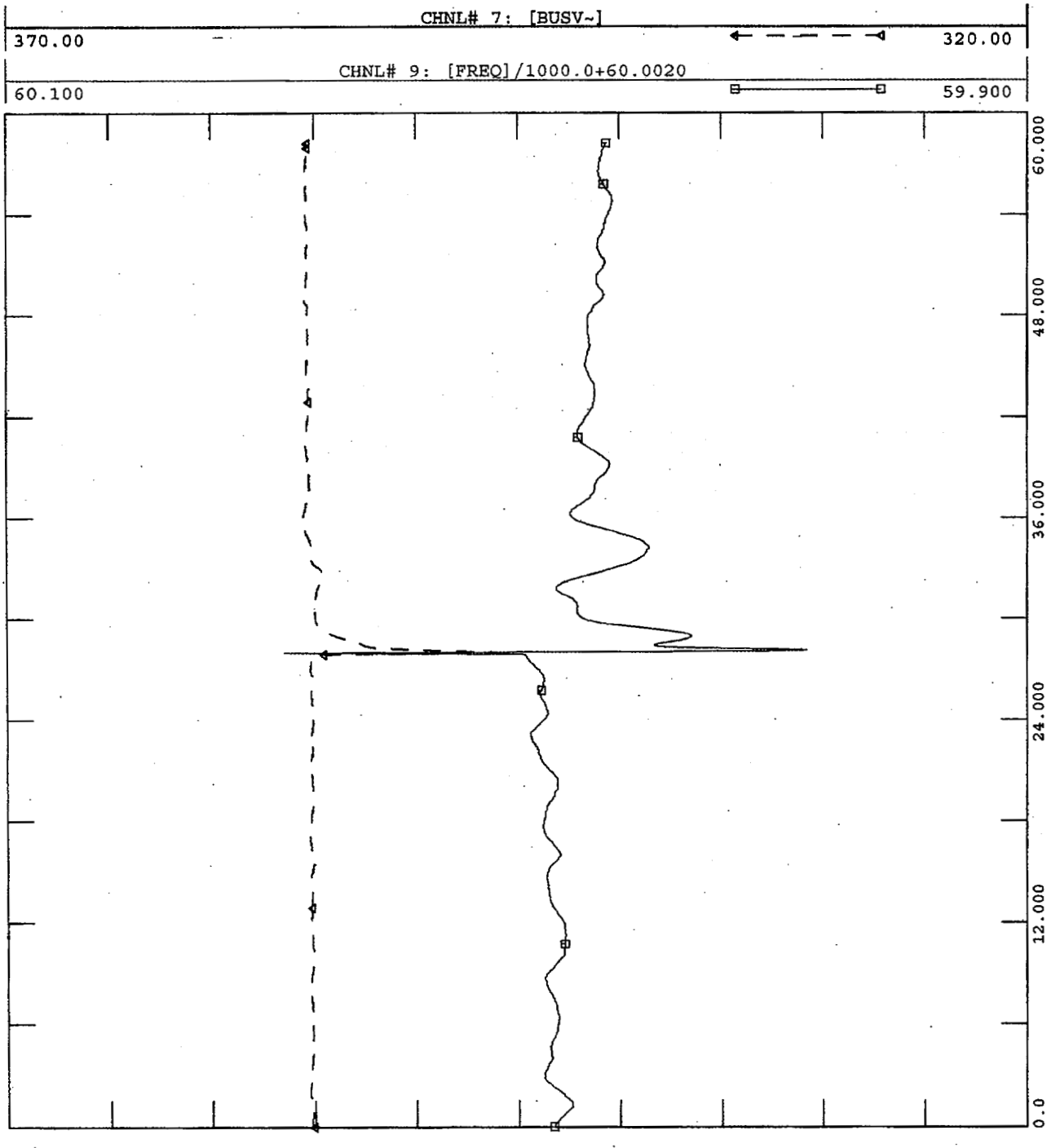
>
> Around 01:40 hr on June 18, there was one event captured by all
> recorders in New England. It looks like a large remote generation trip
> from the frequency signature. Do you know what was happening at that
> time frame? I have sent an e-mail to NYISO to check out.
>
> I only plotted the frequency traces from IEDs. If you need to see
> other quantities, please let me know.
>
>
> << NIUT04D5.pdf>> <<06_18_2004_VY.doc>>
>
> Xiaochuan Luo
> Business Architecture & Technology
> ISO New England Inc
> One Sullivan Road
> Holyoke, MA 01040
> Tel: (413) 540 4236
> Fax: (413) 540 4226
>

NIUT04D5.XXX @ 2880 = 170:06:40:40.6441.
COLLAPSE = 4, W0 = 60.00208 HZ
TRIP OF VERMONT YANKEE 6/18/04

FILE: NIUT04D5.out

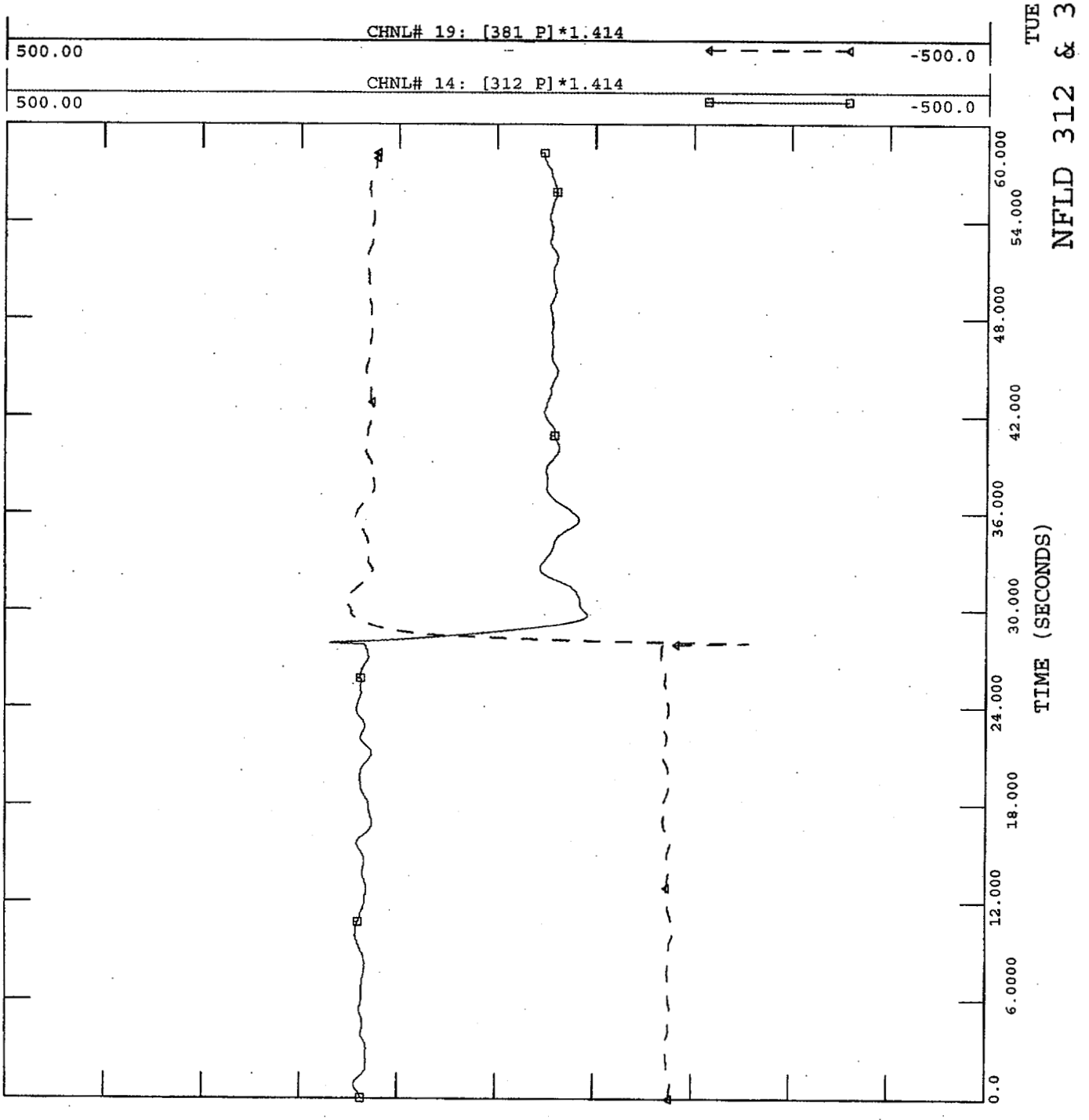
TUE, JUN 22 2004 11:28

NFLD FREQ AND VOLTAGE



NIUT04D5.XXX @ 2880 = 170:06:40:40.6441.
COLLAPSE = 4, W0 = 60.00208 HZ
TRIP OF VERMONT YANKEE 6/18/04

FILE: NIUT04D5.out



TUE, JUN 22 2004 11:28

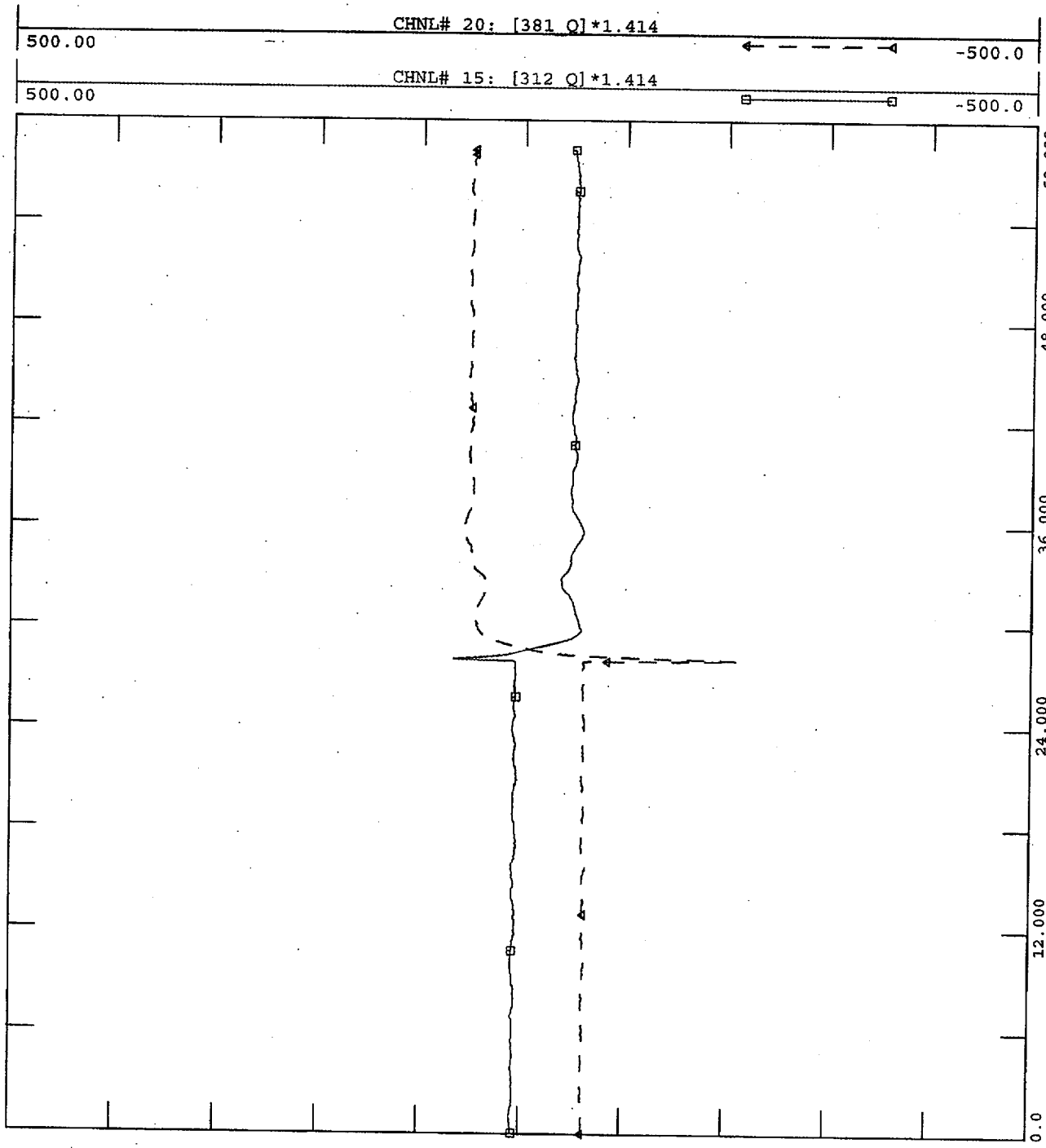
NFLD 312 & 381 LINE MW FL

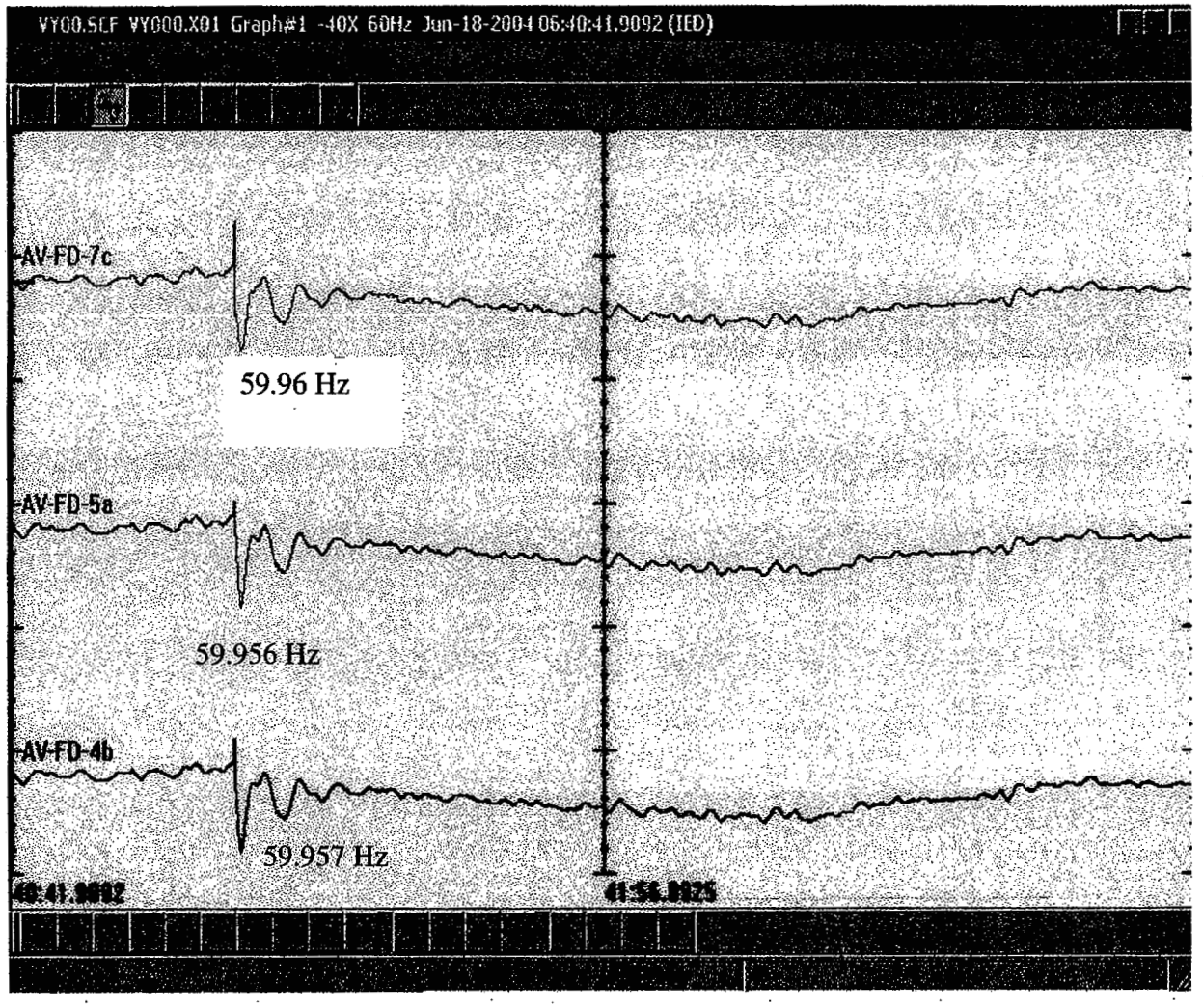
NIUT04D5.XXX @ 2880 = 170:06:40:40.6441.
COLLAPSE = 4, W0 = 60.00208 HZ
TRIP OF VERMONT YANKEE 6/18/04

FILE: NIUT04D5.out

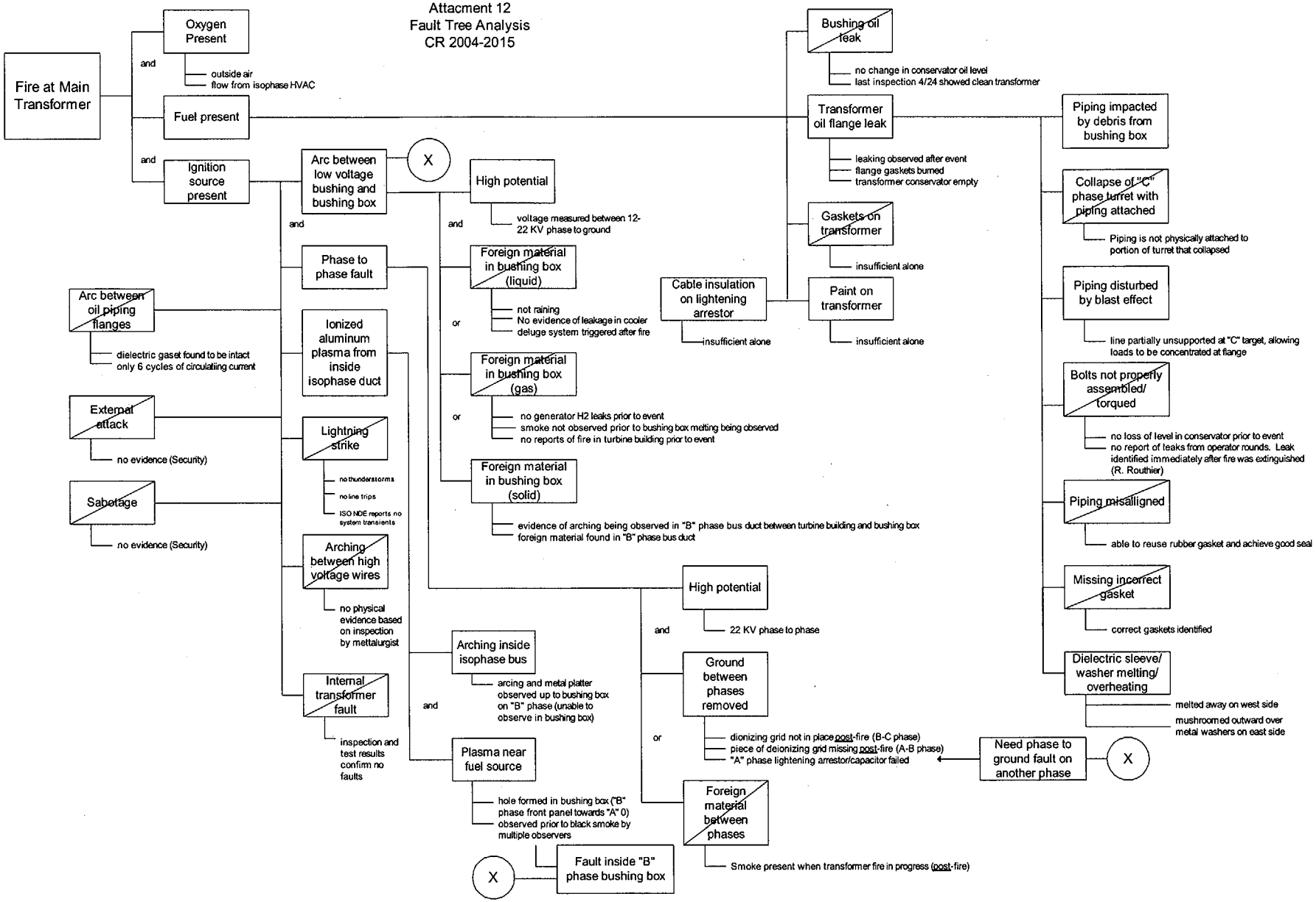
TUE, JUN 22 2004 11:28

NFLD 312 & 381 LINE MVAR




VY00.SCF VY000.X01 Graph#1 -40X 60Hz Jun-18-2004 06:40:41.9092 (IED)
AV-FD-7c
59.96 Hz
AV-FD-5a
59.956 Hz
AV-FD-4b
59.957 Hz

Attacment 12
Fault Tree Analysis
CR 2004-2015



ATTACHMENT 13
CR-VTY-2004-2015
Extent of Condition Evaluation of Power System Surge Arresters

Summary

This evaluation found that there are risk to generation surge arresters located on the Main Transformer, Startup Transformers, Isophase Bus and risk to generation surge capacitors located on the Recirc MG sets. The evaluation determined that the arresters on the high side of the Main Transformer and high and low side of the Startup Transformers are acceptable for operation. The arresters in the Isophase Bus and low side of the Main Transformer will be replaced prior to restart from the current forced outage. In addition, other arrester PM tasks should be modified to allow more detailed testing of arresters in specific power system applications.

Questions to answer during the extent of condition review.

1. Identify any power system surge capacitors, surge arresters and lightening arresters that are a risk to generation.

Lightning (surge) arresters and or capacitors were identified in the following system locations in the power systems at ENVY; (Ref G-191298 sh.1, CR-VTY-2004-2173)

345KV

1. T-1-1A High side
2. 340 Line – Coolidge
3. 379 Line – Scobie
4. 381 Line – Northfield
5. T-4-1A High side

115KV

6. T-4-1A Low side
7. K-40 Line (Not installed)
8. K-186 Line
9. T-3-1A High side
10. T-3-1B High side

22KV

11. TG-1-1A surge cubicle
12. T-1-1A Low side

15KV

13. 13L2 line, Vernon Tie line.

4KV

14. T-3-1A Low side
15. T-3-1B Low side
16. DG-1-1A Output
17. DG-1-1B Output
18. MG-1-1A Motor Capacitor
19. MG-1-1B Motor Capacitor

From the applications listed above the following were classified as a risk to generation (R), a limit to generation capacity (L) or could cause a limited condition of operation to be entered (LCO)

345KV

1. T-1-1A High side (R)
2. 340 Line – (no restrictions)
3. 379 Line – Scobie (L)
4. 381 Line – Northfield (L)
5. T-4-1A High side (LCO)

115KV

6. T-4-1A Low side (LCO)
7. K-40 Line. (Not installed.)
8. K-186 Line (LCO)
9. T-3-1A High side (R)
10. T-3-1B High side (R)

22KV

11. TG-1-1A surge cubicle (R)
12. T-1-1A Low side (R)

15KV

13.13L2 line, Vernon Tie line. (Admin LCO)

4KV

14. T-3-1A Low side (R)
15. T-3-1B Low side (R)
16. DG-1-1A Output (LCO)
17. DG-1-1B Output (LCO)
18. MG-1-1A Motor Capacitor (R)
19. MG-1-1B Motor Capacitor (R)

2. Determine if the components identified in 1. above are included in the PM (Preventive Maintenance) program.

345KV

1. T-1-1A High side, Included. PM Basis E051, File 2. Diagnostic testing of lightning arresters.
2. 340 Line – Coolidge (345KV-YARD) Included. PM Basis E005, File 403, Perform annual visual inspection of the switchyard.
3. 379 Line – Scobie (345KV-YARD) Included. PM Basis E005, File 403, Perform annual visual inspection of the switchyard.
4. 381 Line – Northfield. (345KV-YARD) Included. PM Basis E005, File 403, Perform annual visual inspection of the switchyard.
5. T-4-1A High side. Included. PM Basis E128, File 50, Surge (lightning) arrester visual and diagnostic inspection.

115KV

6. T-4-1A Low side. Included. PM Basis E128, File 50, Surge (lightning) arrester visual and diagnostic inspection.
7. K-40 Line – None.
8. K-186 Line (115KV-YARD). Included. PM Basis E005, File 403, Perform annual visual inspection of the switchyard. File 50, 6th refueling surge (lightning) arrester visual and diagnostic testing.
9. T-3-1A High side. Included. PM Basis E126, File 50, Surge (lightning) arrester visual and diagnostic inspection.
10. T-3-1B High side. Included. PM Basis E126, File 50, Surge (lightning) arrester visual and diagnostic inspection.

22KV

11. TG-1-1A surge cubicle (ISOPHASE-BUS) No PM file text specifically addresses testing the lightning arresters in this cubicle. PM Basis E077, File 50 should be revised.
12. T-1-1A Low side. No PM file text specifically addresses electrically testing the lightning arresters in this cubicle . PM Basis E051, File 2 should be revised.

15KV

13. 13L2 line, Vernon Tie line. (T-VERNON-HYDRO). Included. PM Basis E125, File 3, RF outage diagnostic testing of T-VERNON-HYDRO transformer. Visual inspection of the LA' s only.

4KV

14. T-3-1A Low side. Included. PM Basis E126, File 10, External visual inspection of Startup Transformer. Visual inspection only.
15. T-3-1B Low side. Included. PM Basis E126, File 10, External visual inspection of Startup Transformer. Visual inspection only.

16. DG-1-1A Output. Included. PM Basis ME039, File 6, Diesel Generator Electrical Inspections per OP 5225. LA's are meggered only.
17. DG-1-1B Output. Included. PM Basis ME039, File 6, Diesel Generator Electrical Inspections per OP 5225. LA's are meggered only.
18. MG-1-1A Motor capacitor. Not included in RP 5277 scope. PM Basis E054, File 2, perform minor motor and generator inspection in accordance with RP 5277.
19. MG-1-1B Motor capacitor. Not included in RP 5277 scope. PM Basis E054, File 2, perform minor motor and generator inspection in accordance with RP 5277.

3. If the components are <u>not</u> in the PM program, evaluate each component to determine if risk to generation is such that the component should be replaced prior to restart from this outage.

The only components that were identified that do not have detailed PM's that are a risk to generation were the surge arresters located in the generator surge cubicle, the low side arresters on the T-1-1A transformer and the surge capacitors on the drive motors of the Recirc MG sets. The surge arresters on the low side of the T-1-1A transformer and in the generator surge cubicle will be replaced prior to restart. The surge capacitors located in the Recirc MG set drive motor connection boxes are not being replaced prior to start up. The surge capacitors in the MG sets should be tested and or replaced at the next opportunity. There have been no reports in the last RP 5277 inspections of the capacitors leaking any oil. This would indicate that the case is still intact and the insulating fluid is performing its function of electrically isolating the device from ground. If the capacitor contains PCB oil, then it should be changed out at the next opportunity.

Other risk to generation arresters identified in this evaluation are the T-1-1A high side arresters and the T-3-1A and T-3-1B high and low side arresters. The T-1-1A arresters were replaced during RFO23 and were recently tested. The T-3-1A and T-3-1B high side arresters were replaced in RFO-24. One of the three low side arresters on the T-3-1A transformer was replaced in 2002, and all of the low side arresters were inspected during RFO-24.

Although only risk to generation arrester applications were identified as part of this evaluation, several weaknesses were found with the existing PM's on other arresters.

Recommendation 1. All of the arresters in the 345KV-YARD asset category are not electrically tested (Doble tested) every outage. This practice should be considered in the future once the equipment limitations are worked out. This need not be performed prior to restart because the arresters were replaced during the last refueling outage RFO-24.

Recommendation 2. The Arresters in the 115KV-YARD specifically on the K186 line are not electrically tested (Doble tested) every outage. This practice should be considered in the future once the equipment limitations are worked out. The K-186 line arresters were not replaced this past outage due to tagging and clearance issues. The K-186 line arrester replacement work has been planned under WO 03-05282-000 and should be completed before the end of RFO-25.

- Basis for why a failure of a 186 line arrester will not affect the station's TS required power supplies. Technical Specification 3.10 "Offsite Immediate Access Power Source" to Vermont Yankee is supplied from the 345kV Transmission System though the 345kV/115kV autotransformer, K1 Breaker, and 115kV Bus to the T-3-1A/B Startup Transformers. A failure of a 186 Line arrester would not affect the operability of this power source. In response to this type of event scenario, the K186 breaker would immediately trip and isolate the arrester from the Vermont Yankee 115kV bus.

Recommendation 3. The 13L2 line arresters on the Vernon Tie-line (T-VERNON-HYDRO) should be electrically tested during the course of the PM tasks during the refueling outages. This need not be performed prior to restart because the arresters were installed in 1993 under EDCR 90-412 and are still relatively new.

Recommendation 4. The T-3-1A and T-3-1B low side arresters only undergo a visual inspection per the PM step text. The PM should be revised to document the performance of electrically testing the arresters. The 5 old arresters should also be replaced during the next refueling outage. The high side arresters were replaced during the past refueling outage RFO24.

- Evaluation of the extent of testing being conducted on the Startup Transformer lightning arresters has revealed that in accordance with PM file 50 and, most recently, Work Order 03-001638, the Startup Transformer lightning arresters, both low and high side, are being Doble tested during regularly scheduled outages. The condition of the Startup Transformer lightning arresters is known and is satisfactory.

Recommendation 5. The arresters on the DG-1-1A and DG-1-1B Outputs are only megger tested per OP 5225. Maintenance Support should consider revising the procedure to require Doble (power factor) testing of the arresters at a specified frequency.

A review of OP 5225 maintenance records shows that for the past three years the megger readings for the three lightning arresters in each EDG PT cabinet (6 total) have been constant at about 11 megohms. The acceptance criterion is 5 megohms. The fact that all six read about the same and have read that way over the period of time reviewed demonstrates that the arresters are in good condition as far as can be determined from the type of testing conducted.

? Additional evaluation supporting the acceptability of the installed lightning arresters without further testing is provided in following analysis:
The neutral of each EDG is high resistance grounded. Therefore, the unexpected shorting of one lightning arrester to ground can be tolerated without affecting system operation. Fault current is limited to less than five amps.

The subject arresters are indoors and are normally de-energized. Therefore, they are not routinely exposed to voltage transients that may occur during 1) interruption of 4kV system loads or 2) lighting strikes affecting the 345kV/115kV transmission system.

The 18 month OP4100 Integrated ECCS Test confirms the arresters do not inadvertently conduct during worst case transient loading conditions (i.e. RHR Pump Sequencing). Operations would be immediately alerted to this condition via actuation of Annunciator CRP 8-H-1 "DG-A Ground," or CRP 8-F-1 "DG-B" Ground." [Note: Monthly testing of the EDGs would also identify the failure of one of the subject lightning arresters if it were to occur through these same annunciators.]

Bus 3 and 4 are supervised by the Bus 1 and 2 high resistance grounding schemes. Additionally, each of the Bus 3 and 4 feeders are equipped with ground fault detectors. Therefore, any ground fault received on the safety related 4kV system (that could potentially challenge an EDG lightning arrester) would be immediately identified and removed for service in a timely manner. [Note: A ground fault on Bus 1 or 2 (or their associated feeders), would have no effect on EDG operation since diesel generator control logic isolates these busses from the safety related portion of the system during an LNP.]

While additional testing might be a desirable enhancement to the maintenance done on these components, the current condition of the of the EDG lightning arresters is satisfactory.

Recommendation 6. The Surge capacitors on the Recirc MG sets should be inspected or replaced during the next refueling outage if they contain PCB's. The maintenance procedure RP 5277 should be revised to electrically test the capacitor during inspections.

ATTACHMENT 14
CR-VTY-2004-2015
Ground Fault Alarm Team Meeting Notes

Note: Following are the team meeting notes from the Ground Fault Alarm Team that met following the initial ground alarm on June 17, 2004.

Team members: Pat McKenney (Management lead), Mike Smaga (Tech lead), George Wierzbowski, Steve Gunnip, Rick Routhier, Gerry Huffman, Doug Amidon, Bob Swanson, Mark Palionis, Jesse Anderson, Brian Pichette, Dan Jefferies, Jon Todd

1:00 Team Meeting GM office
3:00 Fleet phone call GM office

Problem Statement:

On June 17, 2004 a ground fault was detected on 22 KV System.

Description of event:

On June 17, 2004 at 06:53, the Main Generator 59N/G1 relay actuated initiating control room alarm 7-A-2. The ground fault lasted for approximately one (1) minute. Both the relay and alarm was reset. A review of plant computer data verified that an actual ground fault did occur for a duration of approximately one (1) minute. The voltage recorded across the generator neutral transformer was 138 volts indicating a solid ground condition. After the fault cleared, the voltage returned to the as-before or normal levels. A telephone call to the local ISO verified there was no external or system disturbance at the time of the plant electrical disturbance.

1. Basis for 59/G1 50 min. timer? (DA/GH) - EBASCO, 1970 design
2. Is reactor sized for continuous duty? (GH),
3. Could the isophase bus duct cooling modification cause this event? (check for change in airflow or temp RR), Nothing found, Maint. inspected cooling system for excessive grease, none found: Belts ok: need to perform a Thermogarphy scan
4. Increase resolution of ERFIS Data (JA) – Done
5. Determine the potential causes of the ground fault (DA/GH/MS/RR)
6. As-left relay timer 59N/G1 setting (SG) - as left 50.22 min.
7. What operator action is required if alarm comes in again? (BRP/GH/DJ)
   a. Notify Plant Manager & Operations Manager
   b. Monitor for five (5) minutes
   c. Reduce power, if alarm is not cleared
   d. After 30 minutes shut the plant down
8. Ask GE if they believe this could be a generator winding issue (RS), initial response not likely but VY is waiting for more information from GE.
9. What tests or inspections can we perform on line? (SG/DJ) Thermography & Transformer oil sampling. – Oil samples taken and sent to vendor
10. What is the potential for another ground fault? (MS with team input)

a. The second spike was the result of a volt meter leads placed across the terminals of the 59N relay

11 What is the potential effect of the transient on plant equipment? (Generator,Isophase Bus) (GH)
12 Which phase is affected? (SG/DA)
13 Down load Beckwith relay data (GS) - Relay not setup to record data
14 Do we expect other alarms if the event occurs again? (SG/GH) - No, not with graded approach
15 Compensatory actions (MEP) - 1) Protect immediate offsite supply, 2) Differ "B" EDG LCO next week,
16 Is backfeed available if trip occurs following 50 minute timer timing out with/without phase-to-phase fault after event? (DA/GH) - Yes
17 Is back feed operable now (answer is yes)
18 Take oil sample and test oil on transformers and compare with oil data taken before the event (Aux and Main) (SG) Oil samples taken, D. Tkatch,-results due in Friday PM, 6/19/04
19 Action plan for S/D Stop List when plant is off line to locate ground fault. (RS/DJ)

New items: added 6/17/04 @1:00 meeting

20 Maintenance to inspect isophase bus duct coolers for excessive grease, lost bolts, belts (J. Todd)
21 Review last 40 days maintenance history (B. Swanson)
22 Set up monitoring equipment in CRP 9-22
23 Monitor neutral output voltage
24 Find what is needed to have the Beckwith relay record event data
25 Take samples of Iso-Phase bus air

ATTACHMENT 15

Analysis of the Events of June 18, 2004 Vermont Yankee

July 12, 2004

Doug Amidon
Nicholas Abi-Samra
Don Ramey

Contents

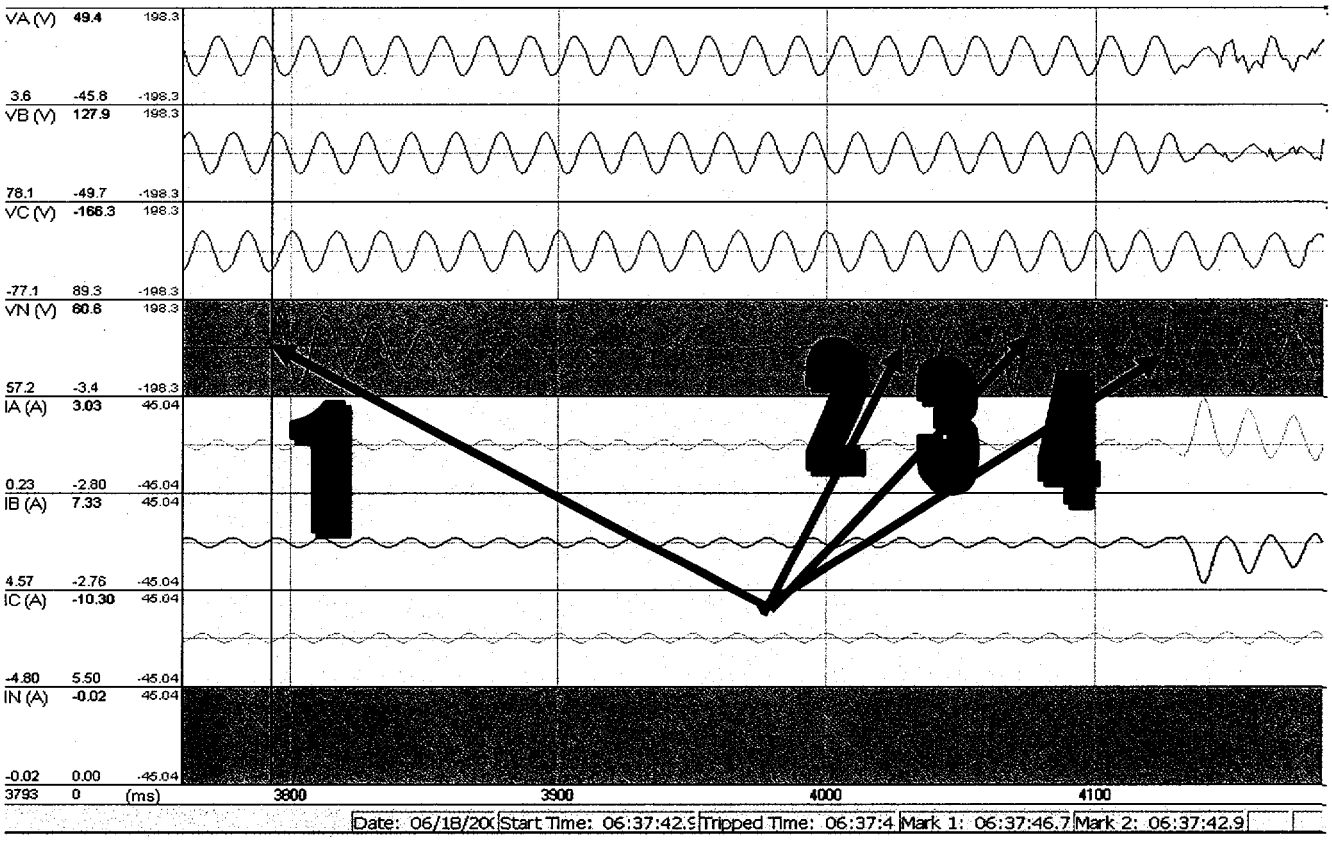
- Approximate method of analysis
- Multiple (4) arcing strikes
- Failure of arrester
- Need for generator arresters
- Partial conclusions

Method of Data Analysis

- Start with the Beckwith Comtrade data
- Confirm the true polarity of Vn
- Derive ground voltages
- Study voltages and make limited conclusions

Arcing Phenomena From Beckwith Output (VLN)

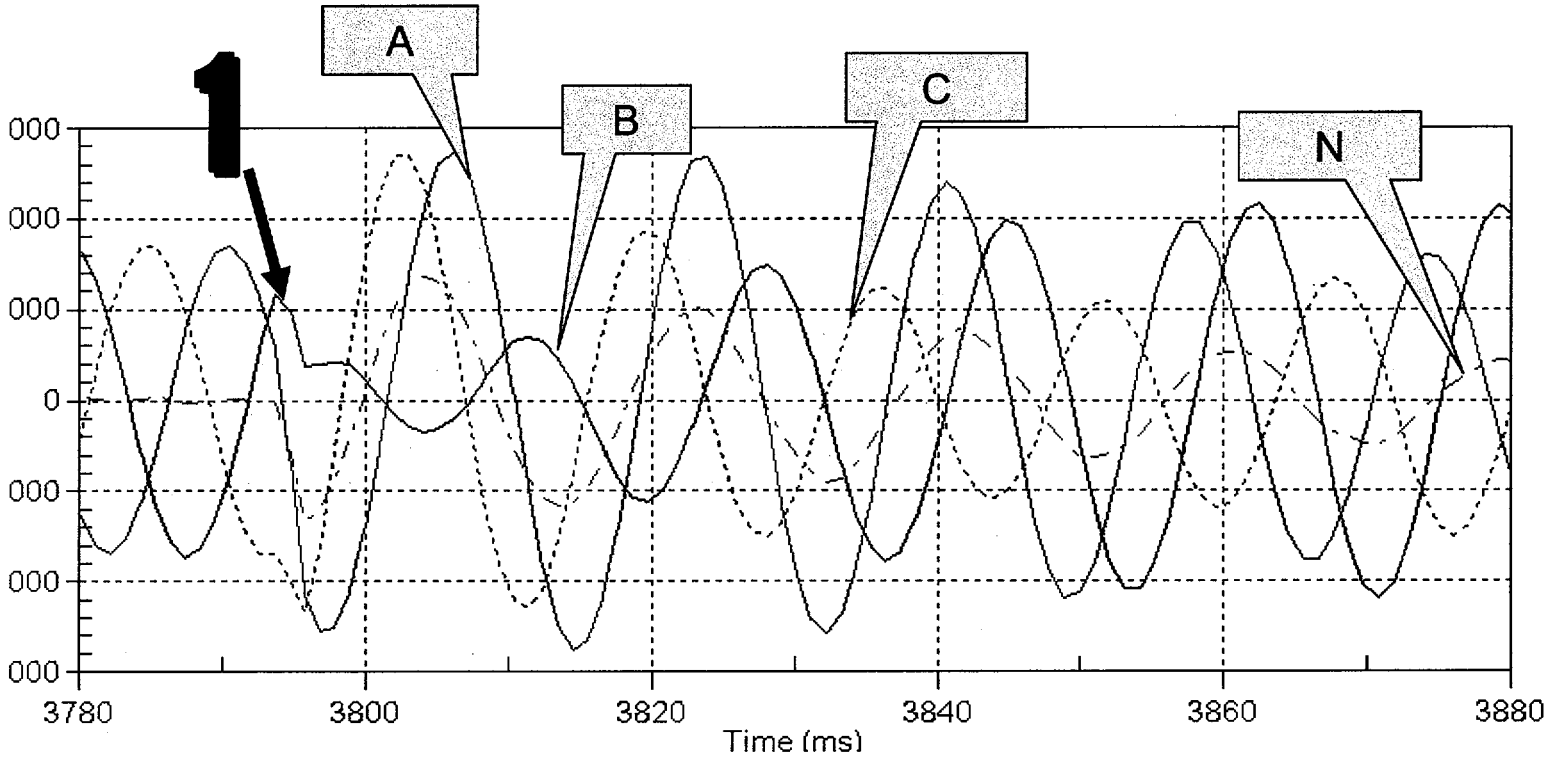
four occasions of arcing at approximately the following times



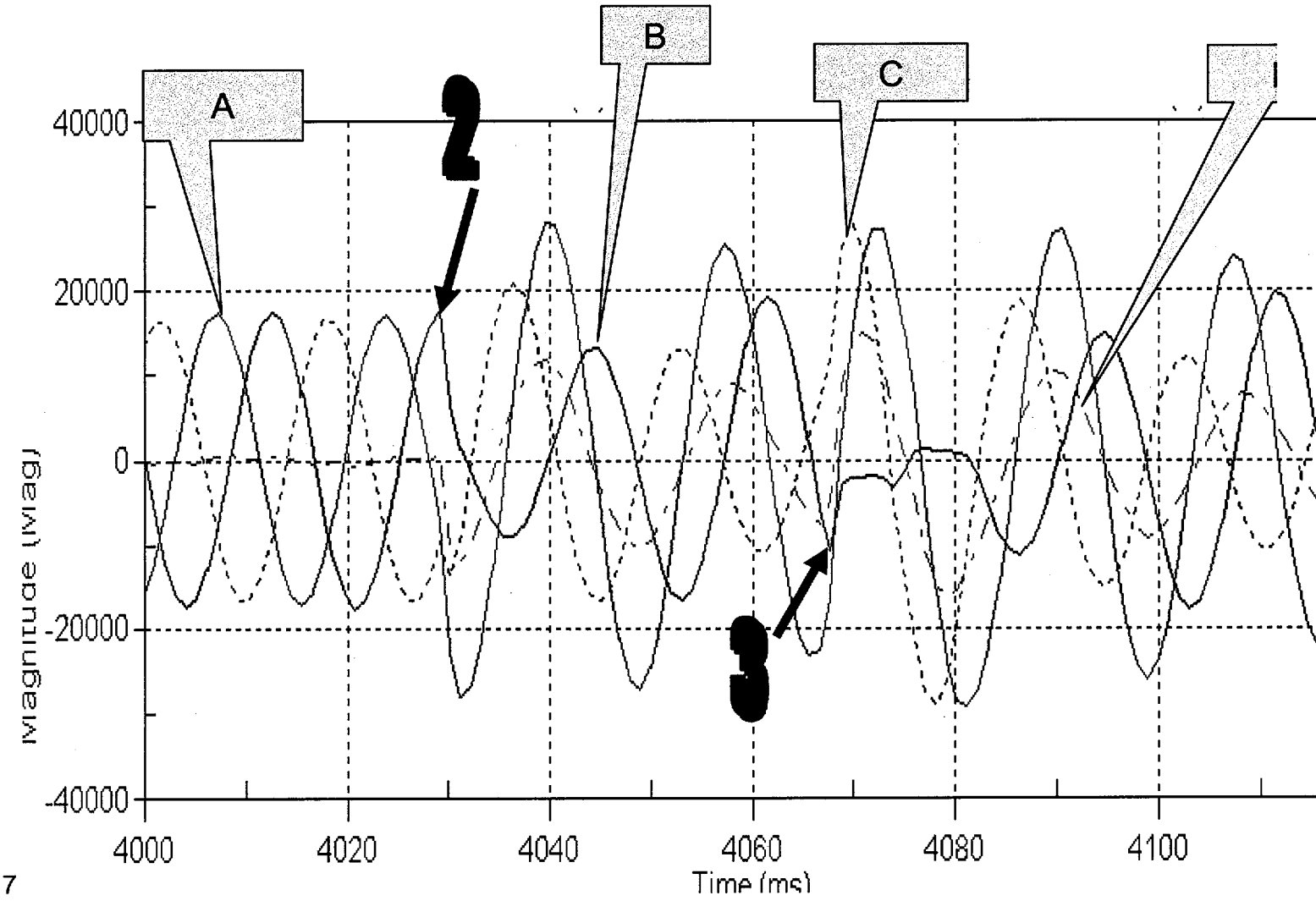
Characteristics of the Voltage Following Arcing

- When arc is removed:
  - Neutral voltage response is oscillatory in nature (due to the RLC circuit)
- Long decay due inherent low resistance of the reactance grounded system
- Due to the slight detuning of the resonating ground tank circuit, the neutral voltage rotates in space with respect to the phase voltages

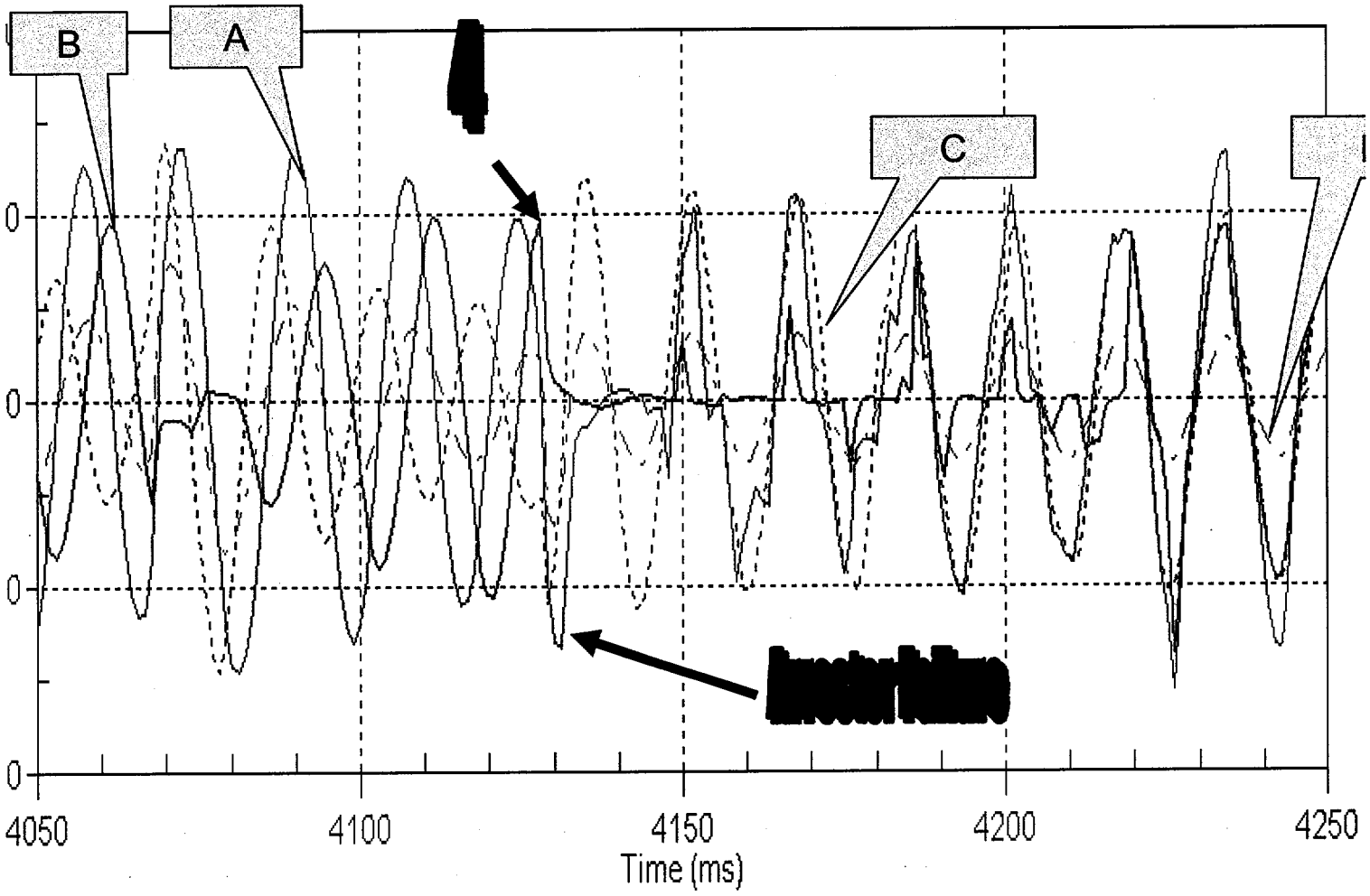
First Arcing Incident



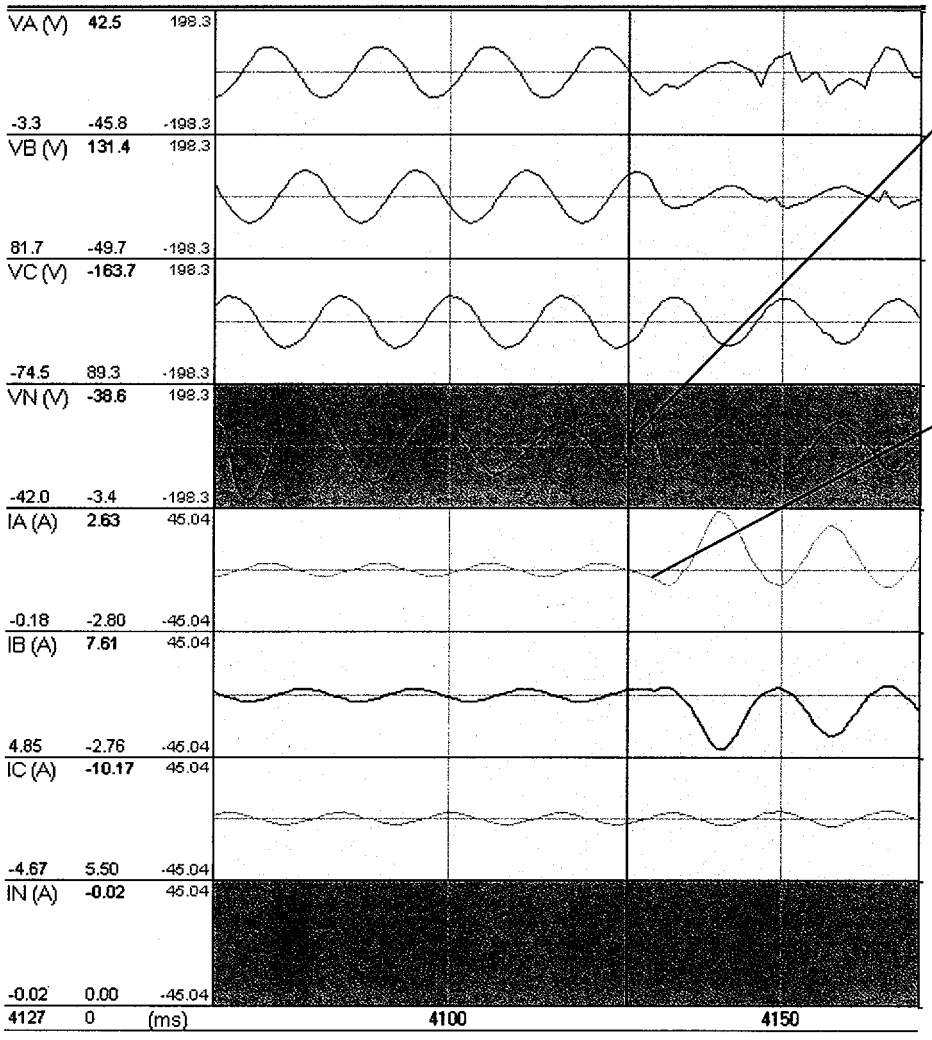
Second and Third Arcing Incidents



Fourth Arcing Incident and Arrester Failure



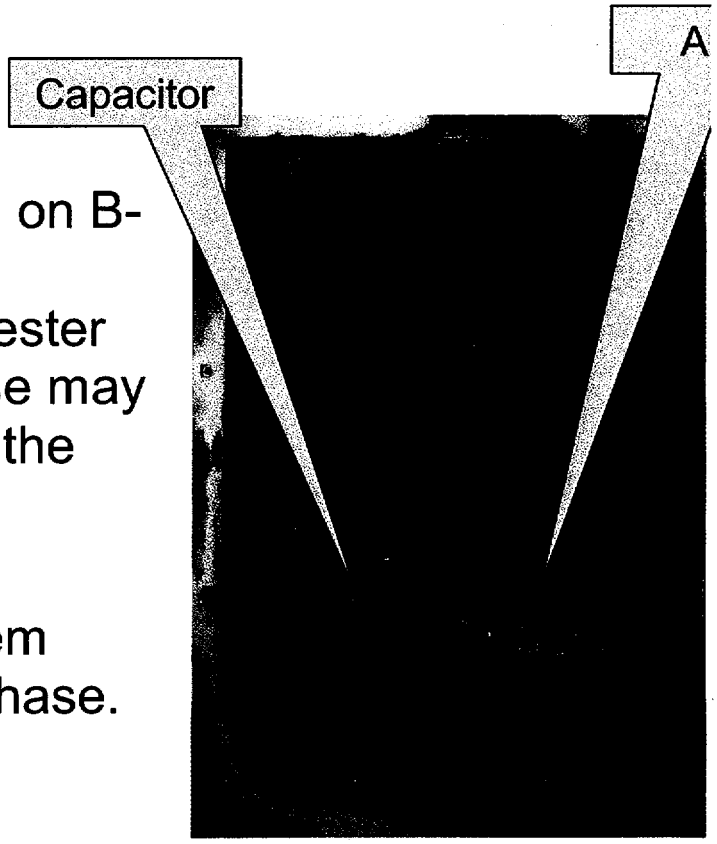
Fourth Arcing and Arrester Failure



Fourth Arcing

Phase to Phase fault due to arrester failure

Conclusions



Arcing due to loose material started on B-Phase. Four such incidents were recorded on 6/18/04, before the arrester on the A-Phase failed. (The B-Phase may also have been subjected to arcing the day before).

The system was subjected to high voltages due to the grounding system design and arcing faults on the B-Phase.

The capacitor did not fail; it was destroyed following the fault.

Evaluate the need for Generator surge arresters and surge capacitors.

ATTACHMENT 16
CR-VTY-2004-2015
Phase "B" Fault Analysis

During inspection of the "B" isophase bus and duct during Damage Assessment following the June 18, 2004, electrical fault and fire event, one of the laminates from one of the isophase bus flexible connectors was found detached from the "B" phase bus. Each laminate is a 4 inch by 17 inch rectangular piece of aluminum, 20 mils (0.020 inches) thick. The flexible connector with the failed laminate was located between the isophase bus duct cooling unit and the Generator Disconnect Switch. (Refer to Figure 1, Location 1, of Root Cause Analysis Report.) Prior to its detachment from the flexible connector, the laminate was located on the upper right hand side (when facing the Main Transformer) of the "B" isophase bus. Figures 1 and 2 show the laminate in the as-found condition both inside and out of the bus duct.

The laminate was found at the bottom of the "B" isolated phase bus duct riser elbow, just outside the Turbine Building where the duct transitions from horizontal to vertical. The laminate was severely twisted and deformed. In the as-found condition, it weighed 38.64 grams which, compared to an undamaged laminate weight of 64.27 grams, represents a weight loss of 25.63 grams or approximately 40% of its original weight. Further evaluation will be performed to determine the parts of the laminate that are missing.

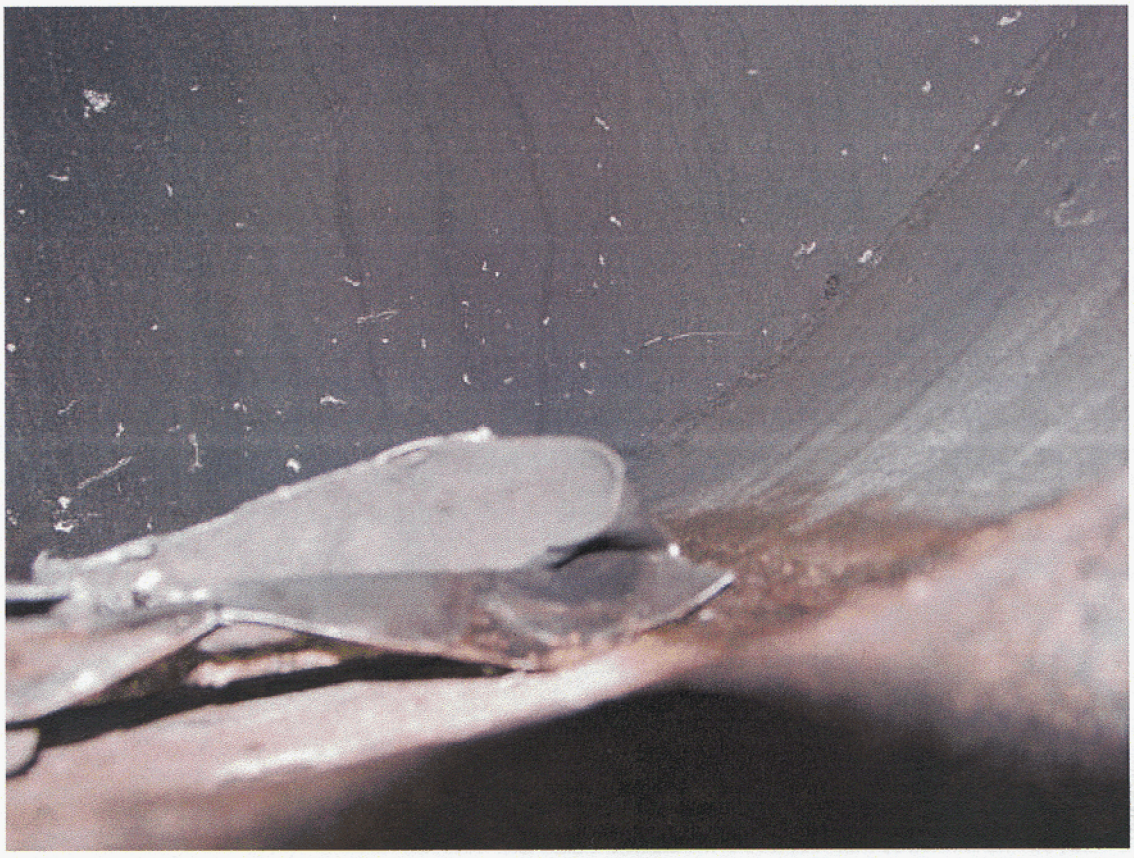


Figure 1
As-Found Condition of Failed Laminate in Isophase Bus Duct

ATTACHMENT 16
CR-VTY-2004-2015
Phase "B" Fault Analysis

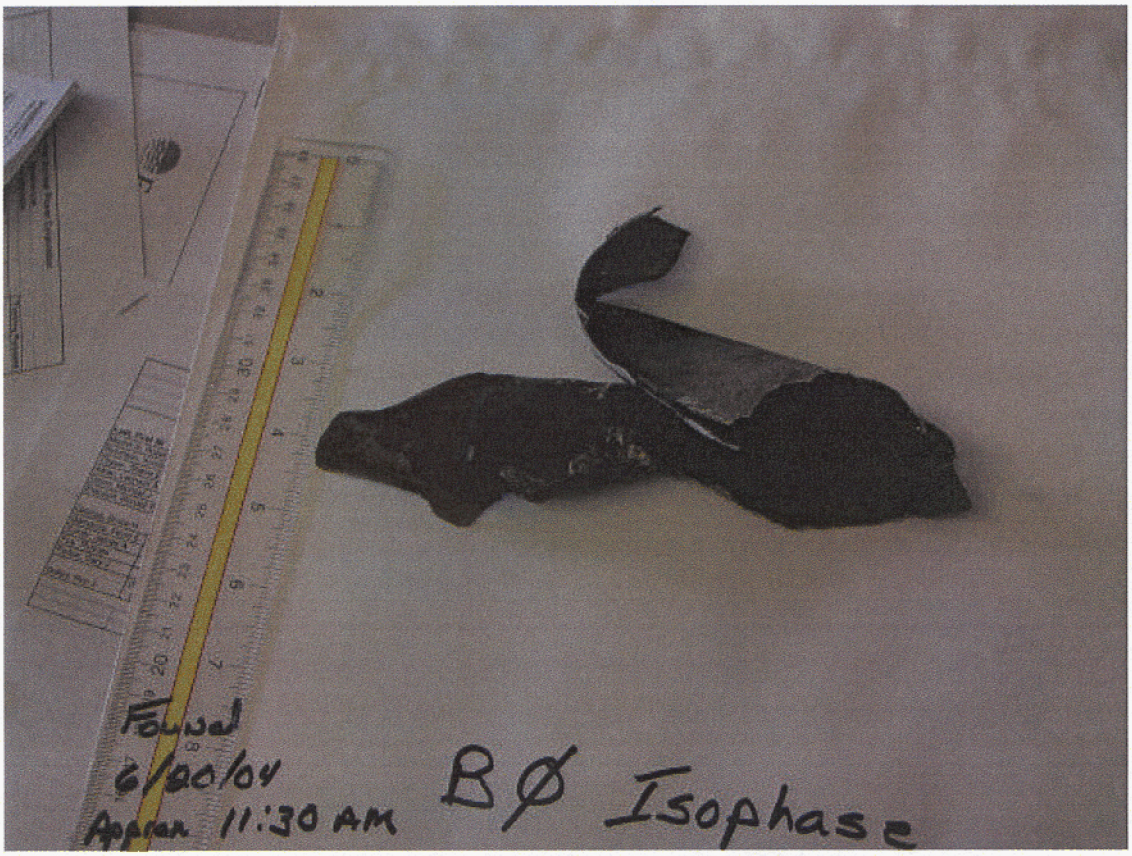


Figure 2
Failed Laminate after Removal from Isophase Bus Duct

As described in Attachment 7A, visual analysis showed that the laminate attachment welds on the "B" phase flexible connector were ground flush or nearly flush with the top surface of the lamina leaving very little weld ligament to retain the laminate sheet. In addition, visual analysis of the failed "B" phase flexible connector weld revealed clear signs of low cycle fatigue cracking, most likely the result of the mechanical stress induced during expansion and contraction of the isophase bus associated with generator load increasing and decreasing, respectively, during its years of service. These two characteristics resulted in a failure along the leading edge (upstream edge with regard to air flow) weld of the top laminate of the flexible connector. The failure surface was covered with an oxide coating that indicated that the weld had cracked at some time in the past.

None of the other seven (7) flexible connectors at this location on the "B" phase isophase bus showed signs of fatigue cracking when examined by visual analysis. Similarly, none of the sixteen (16) flexible connectors at this location on the "A" and "C" phases showed signs of fatigue cracking when examined by visual analysis.

ATTACHMENT 16
CR-VTY-2004-2015
Phase "B" Fault Analysis

Analysis of the failed flexible connector revealed that once the leading laminate edge failed, the laminate was easily torn along the trailing edge by the airflow in the isophase bus duct.

The Isolated Phase Bus Cooling Unit supplies air flow outward to the Main Generator and to the Main Transformer through the "B" isophase bus duct, with return through the "A" and "C" isophase bus ducts. This configuration results in twice as much air flow through the "B" isophase duct as through the "A" and "C" isophase bus ducts.

The airflow in the isophase bus cooling system before its modification during refueling outage RFO24 was approximately 10,500 standard cubic feet per minute (scfm). The estimated air velocity in the "B" isophase bus duct to the Main Transformer before modification was between 1870 and 2245 feet per minute. The range is provided because as-found air flow readings in the section of the duct were not recorded at the start of the outage.

Following modification and rebalancing of the system during RFO24, the air flow in the "B" isophase bus duct increased to approximately 17,300 scfm, resulting in an air velocity of approximately 3750 feet per minute in the "B" isophase bus duct to the Main Transformer.

There was no evidence of flow induced vibration caused by turbulent air flow over the laminate. If flow induced vibration were the cause of the failure, indication of crack initiation would be expected to be seen on at least one of the other seven flexible connectors located at the same location. In addition, if flow induced vibration had caused the failure, vibration levels would have intensified following the increase of air flow at the end of the RFO24 refueling outage, and the leading edge failure surface would not have had adequate time to oxidize.

A combination of excessive grinding (reinforcement removal) and low cycle fatigue cracking resulted in failure of the laminate and eventual separation from the bus. Appendix 7A concluded that increased air flow within the duct following the refueling outage was not the cause of the failed flexible connector; however, the higher air flow rates were believed to have accelerated the failure timetable for the laminate. Attachment 7A also concluded that failure would have occurred at some time in the future at the original air flow rates.

It can be concluded that the laminate failure occurred either during the shutdown leading into RFO24 or during the isophase bus duct system testing or plant startup (prior to generator being placed on-line) at the end of the outage. The basis for that conclusion is that the trailing edge of the failed laminate was not oxidized, and therefore the failure would have occurred in a fairly recent time period. In addition, the absence of arc strikes upstream of the riser indicates that the isophase bus was de-energized with the fans running at the time of failure.

ATTACHMENT 16
CR-VTY-2004-2015
Phase "B" Fault Analysis

During Damage Assessment inspection, one-hundred percent of the isophase bus and bus duct were inspected for arc strikes and debris. Arc strikes were found along the length of the "B" isophase bus and duct from the standoff insulator just outside of the Turbine Building to the low voltage bushing box. There were no arc strikes seen inside the Turbine Building on the "B" isophase bus or duct; likewise, there were no arc strikes found along the entire length of the "A" and "C" isophase bus and duct. Other than the failed laminate, no meaningful loose parts, debris or other foreign material were found inside the duct.

The inspection and Doble testing of the isophase bus and the standoff insulators during RFO24 did not detect the presence of any loose parts, debris or foreign material in the bus duct.

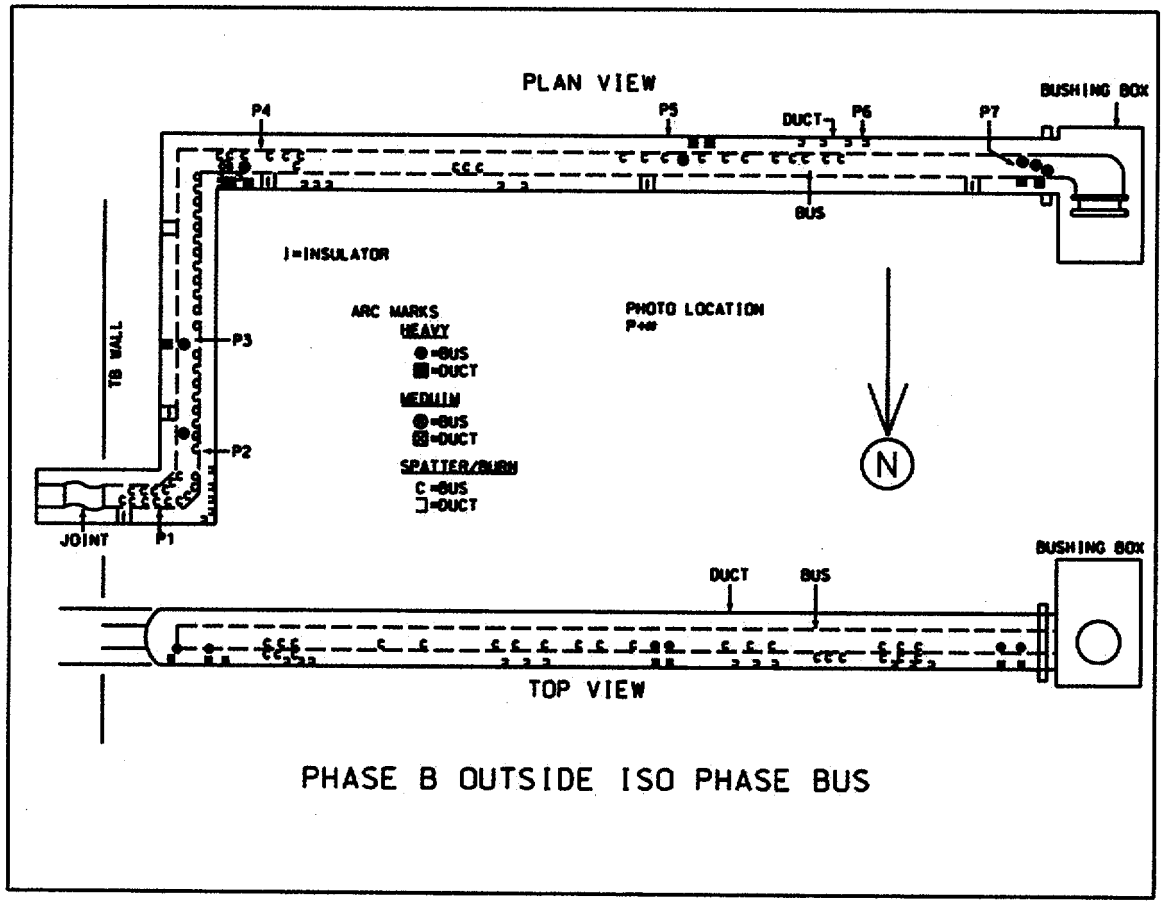


Figure 3
Diagram Showing Density of Arc Strikes Along "B" Isophase Bus Duct From Turbine Building Wall to Low Voltage Bushing Box at Main Transformer

ATTACHMENT 16
CR-VTY-2004-2015
Phase "B" Fault Analysis

Figure 3 shows a map of the arc strikes along the length of the "B" isophase bus duct. Pictures of the arc strikes at the locations designated P1 through P7 are provided in Attachment 17A. The length of the isophase bus and bus duct from the Turbine Building wall to the low voltage bushing box is 50 feet.

Note that the arc strikes are quite numerous in the lower portion of the vertical section of bus and duct and rather uniform up the vertical section. There are fewer arc strikes along the horizontal run of bus and duct; this indicates that the material causing the arc strikes moved more rapidly through the horizontal section of bus duct. It is also notable that the heaviest arc strikes occurred at the transition from the vertical to the horizontal run and a few feet before entering the bushing box.

Based on a partial visual examination of the failed laminate, it can be concluded that, at some period following its detachment, at least one portion of the laminate (and probably more) broke off from the large (4 inch by 17 inch) piece. Because the detached piece(s) were not found during the inspection, it can be concluded the piece(s) was (were) carried by the air flow up the "B" isophase bus duct vertical section and through the horizontal section into the "B" phase low voltage bushing box. Further evaluation of the failed laminate is required to determine how many pieces could have become detached from the large piece and their relative size.

At this time it is not clear if some other source of material or debris caused the arc strikes that were seen along the "B" isophase bus and bus duct. The fact that foreign material from the modification installation was not found during the inspections of the "B" phase duct indicates that the Foreign Material Exclusion controls that were implemented during modification of the fan cooler unit and bus during RFO24 were effectively implemented. However, because a comprehensive inspection of the bus and bus duct was not conducted at the end of the work activity, the possibility of material or debris in the bus duct that was previously introduced cannot be ruled out.

Note: Four pieces of foreign material were found during the Damage Assessment inspection of the isophase bus and bus duct:

- CR-VTY-2004-2043 identified a piece of weld wire in the "A" bus near the Main Generator flexible links. There was no work done on the isophase bus that used the identified form of weld wire during RFO24, and therefore it is felt that the weld wire was introduced at a previous outage.
- CR-VTY-2004-2084 identified two tags and two helical metal segments in the isophase bus duct cooler intake section. This material is believed to have come from vendor-supplied components that were installed during the modification.
- CR-VTY-2004-2114 identified two small pieces of material found in the "B" isolated phase bus duct. These pieces were not in the duct when the detached flex connector laminate was discovered and were introduced during disassembly of the bus and bus duct external to the Turbine Building.

- CR-VTY-2004-2118 identified a piece of weld wire that was imbedded in a weld seam of the "B" isophase bus duct. The weld wire was inadvertently introduced during original fabrication of the bus duct.

There is the possibility that the increased cooling air flow within the bus duct contributed to the lifting of the piece(s) and caused its (their) migration along the duct. Although this is a possibility, the arcing could have resulted in the fault occurring at any point along the "B" phase isophase bus and bus duct where the arc strikes were experienced. In other words, wherever the laminate (and possibly other material) drew a sustained arc, the "B" phase fault could have occurred. The possibility also exists that the increased air flow may have prevented ionization caused by the arcing from reaching the level where a sustained arc occurred and, in turn, prevented the fault until the piece(s) entered the low voltage bushing box and reached a relatively low flow area.

Based on the information available, the following can be concluded:

1. One piece of laminate failed due to a combination of excess grinding and low cycle fatigue cracking over a period of time. Air flow carried the laminate down the duct to the vertical elbow where a portion of the original laminate was found.
2. The laminate failure and detachment occurred during refueling outage RFO24 when the isophase bus was de-energized.
3. Foreign material controls were effectively implemented during modification of the fan cooler unit and bus during RFO24.
4. Material traveled vertically and then horizontally along the energized "B" isophase bus duct from the position that the laminate was found to the "B" low voltage bushing box, causing arc strikes and momentary grounds during its passage.
5. The most probable source of the material was the missing portion of the failed laminate. There may have been additional material from an unidentified source.
6. The fault that occurred in the "B" phase low voltage bushing box was probably the result of the material that caused the arc strikes on the "B" isophase bus and bus duct.
7. The fault that occurred in the "B" low voltage bushing box could have occurred at any point along the "B" phase bus and bus duct where the arc strikes were experienced
8. There is no evidence that the modifications that were installed and tested during the RFO24 refueling outage were the cause of the fault on the "B" phase.

Further work will be done to attempt to better understand the source of the arc strikes seen on the "B" isophase bus and bus duct and to determine why the fault occurred in the "B" low voltage bushing box.

ATTACHMENT 16A
CR-VTY-2004-2015
Pictures of Arc Strikes Along "B" Isophase Bus and Bus Duct

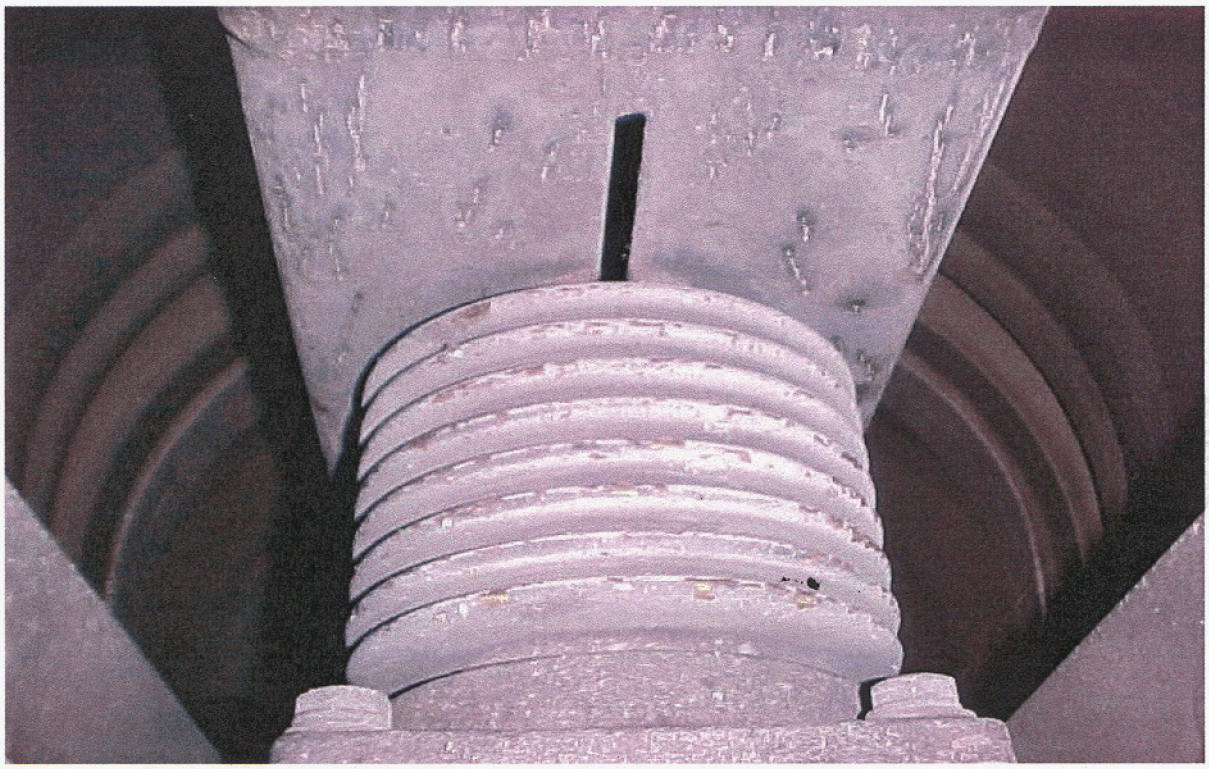


Figure 1
Arc Strikes at Location P1 on Figure 3 of Attachment 16

ATTACHMENT 16A
CR-VTY-2004-2015
Pictures of Arc Strikes Along "B" Isophase Bus and Bus Duct

Figure 2
Arc Strikes at Location P2 on Figure 3 of Attachment 16

ATTACHMENT 16A
CR-VTY-2004-2015
Pictures of Arc Strikes Along "B" Isophase Bus and Bus Duct

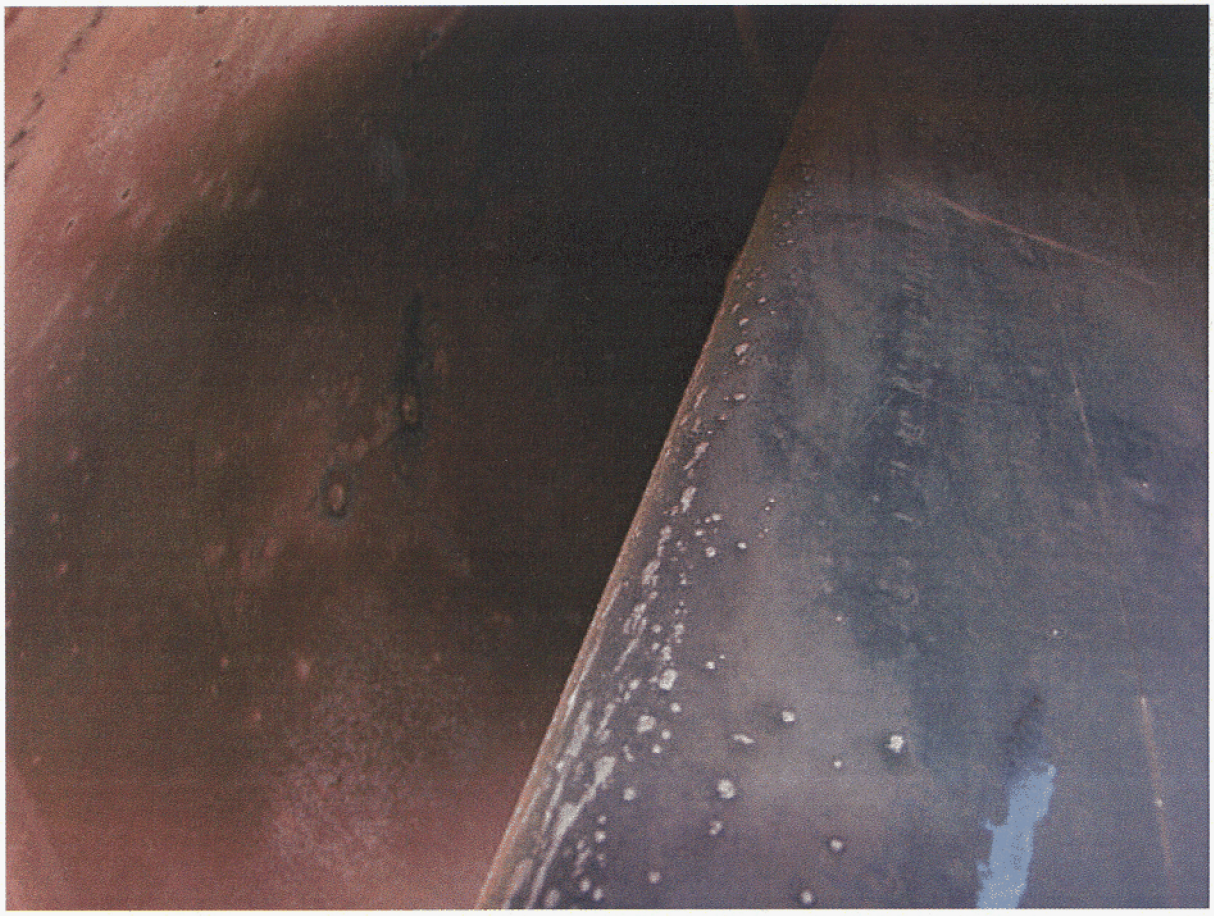


Figure 3
Arc Strikes at Location P3 on Figure 3 of Attachment 16

ATTACHMENT 16A
CR-VTY-2004-2015
Pictures of Arc Strikes Along "B" Isophase Bus and Bus Duct

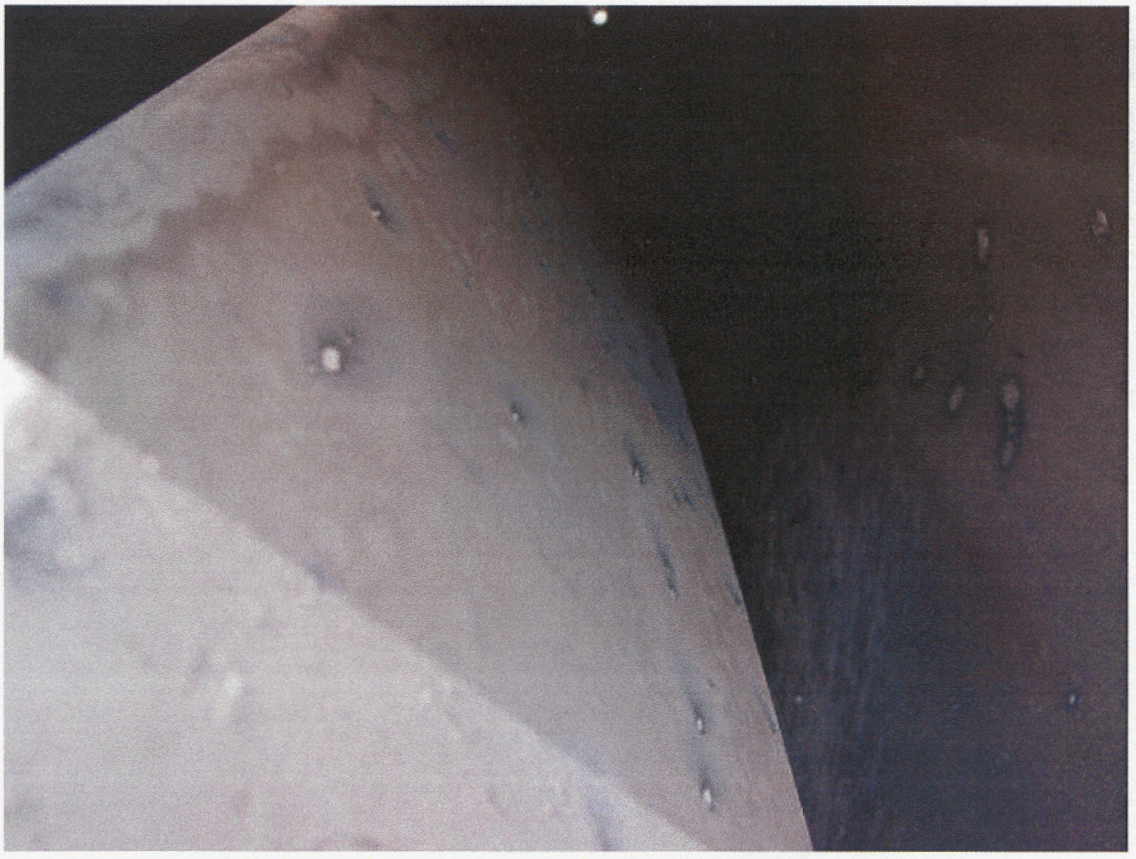


Figure 4
Arc Strikes at Location P4 on Figure 3 of Attachment 16

ATTACHMENT 16A
CR-VTY-2004-2015
Pictures of Arc Strikes Along "B" Isophase Bus and Bus Duct

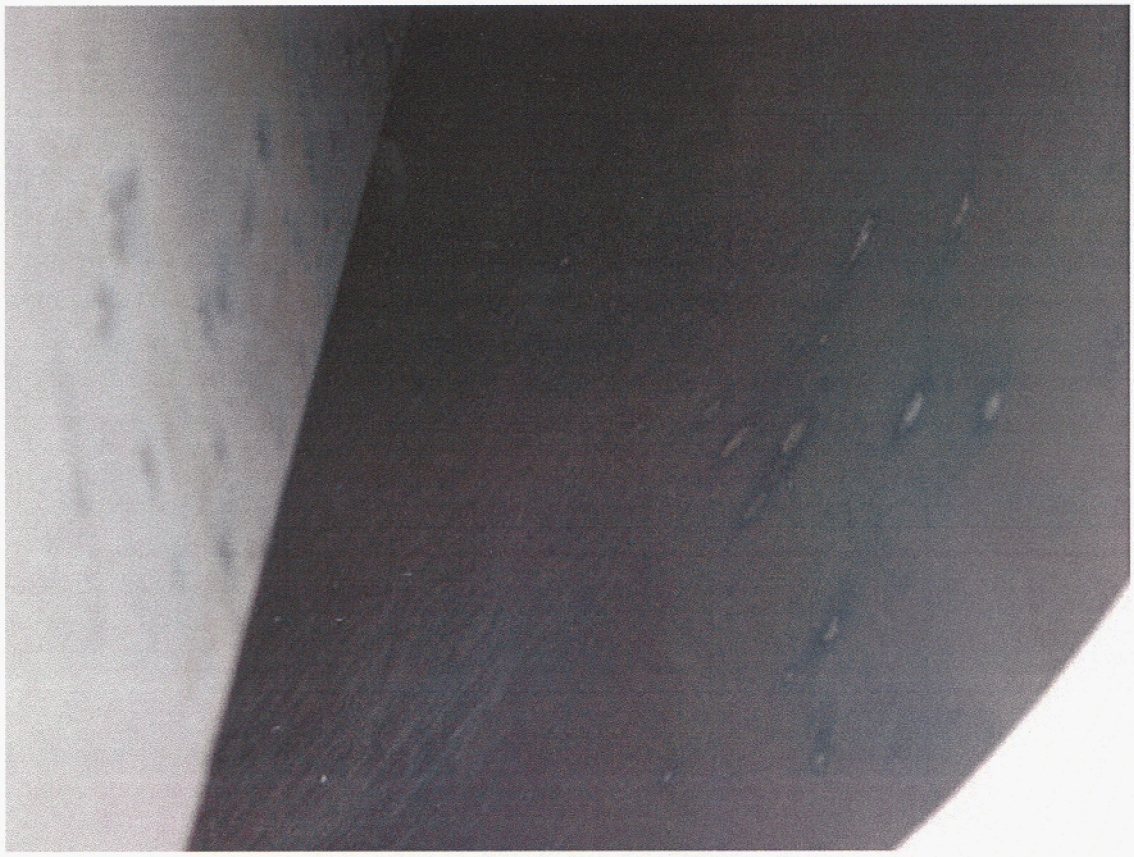


Figure 5
Arc Strikes at Location P5 on Figure 3 of Attachment 16

ATTACHMENT 16A
CR-VTY-2004-2015
Pictures of Arc Strikes Along "B" Isophase Bus and Bus Duct

Figure 6
Arc Strikes at Location P6 on Figure 3 of Attachment 16

ATTACHMENT 16A
CR-VTY-2004-2015
Pictures of Arc Strikes Along "B" Isophase Bus and Bus Duct

Figure 7
Arc Strikes at Location P7 on Figure 3 of Attachment 16

ATTACHMENT 17
CR-VTY-2004-2015
Barrier Analysis Worksheet

CONSEQUENCE(S)	BARRIER(S) THAT SHOULD HAVE PRECLUDED	BARRIER ASSESSMENT [WHY THE BARRIER(S) FAILED]
Loose material was present in the "B" isophase bus duct, resulting in a bus-to-ground fault.	Operating Experience	Lessons learned / recommendations included in SOER 90-01, EPRI Guide TR-112784, Palo Verde event and Clinton event were not incorporated into inspection requirements.
Loose material was present in the "B" isophase bus duct, resulting in a bus-to-ground fault.	Plant Preventive Maintenance (PM) Program	Periodic inspections of the isophase bus flexible connectors were not included in the PM program.
Loose material was present in the "B" isophase bus duct, resulting in a bus-to-ground fault.	Plant Modification Process	Plant modification package to increase ventilation flow in the isophase bus duct did not require a complete inspection of the bus duct / flexible connectors.
Loose material was present in the "B" isophase bus duct, resulting in a bus-to-ground fault.	Manufacturer fabrication quality control process	Sub-standard weld buildup on the failed flexible connector allowed laminate to detach.
Loose material was present in the "B" isophase bus duct, resulting in a bus-to-ground fault.	Plant Design	Isophase bus duct inspection port location / accessibility made it difficult to complete a thorough inspection of the bus duct.
The "A" surge arrester failed, resulting in a fault to ground.	Operating Experience	Lessons learned / recommendations included in EPRI Guide TR-112784, as well as the South Texas, Salem, and Palisades events not incorporated into periodic testing program requirements.

ATTACHMENT 17
CR-VTY-2004-2015
Barrier Analysis Worksheet

CONSEQUENCE(S)	BARRIER(S) THAT SHOULD HAVE PRECLUDED	BARRIER ASSESSMENT [WHY THE BARRIER(S) FAILED]
The "A" surge arrester failed, resulting in a fault to ground.	Plant Preventive Maintenance Program	The preventive maintenance program did not provide for periodic testing of the surge arresters
The "A" surge arrester failed, resulting in a fault to ground.	Plant Alarm Response Procedure	The lack of alarm response procedure requirement to continue plant shutdown in the event the alarm clears allowed the bus to remain energized for an extended period.
An oil fire occurred in the vicinity of the "C" low voltage bushing box	Component design / installation	The flange associated with the oil line became displaced, resulting in an oil leak and an oil source for the fire.

ATTACHMENT 18
CR-VTY- 2004-2015
Related Condition Reports

CR #	Disc Date	Closed Date	Condition Description	Current Significance	Owner Group	Equipment	Systems	Condition Discussed in CR 2004-2015
CR-VTY-2004-01989	06/17/2004		Generator Ground At 06:53 Annunicator 7-A-2 (Gen Gnd Current Hi) came in.	B - ACE	Eng SUP EWC EFIN Mgmt	22KV	22KV	X
CR-VTY-2004-02000	06/17/2004	07/13/2004	Isophase bus duct cooling alarm Control room operators swapped generator leads fans from GLF-1A to GLF-1B. When swapped, control room received 7-D-8 " GEN LEADS FAN HX FLOW LO" alarm. Local operator checked tbccw valve line up and that "B" fan was running. The control room then swapped back to the	C - MPC & CORRECT	Maint Support Mgmt	GLF-1B FS-108-20B	TG MISC	
CR-VTY-2004-02003	06/18/2004		Community Alert Network (CAN) database does not allow all ERO personnel to call-in at UE or UET. Problem identified during UE pager activation. Previously only Duty Team Members were assigned EP pagers and were notified of all event classifications. Now that the entire organization has been issued pagers the CAN database needs to be updated to allow all personnel to call-in and receive the emergency message. Currently if you are not a duty team member CAN will only recognize your password at an Alert classification or higher. When non-duty team personnel called in today the CAN system did not recognize their passwords	C - MPC & CORRECT	E-Plan Mgmt			
CR-VTY-2004-02005	06/18/2004		Misoperation of NAS phone system. At 0702 on 6/18/04, an attempt was made to perform the 15 minute notification call of an Eplan event to VT, NH, and MA State Police. The call was placed via the new NAS phone system. All three states answered the group phone call and the declaration of an UE message was read into the phone. At the end of the message none of the states acknowledged that they received the information. It was then realized that the states were not hearing the message over the NAS phone. Individual calls were then made to all three states via the existing orange phone. This delay resulted in the 15 minute time limit being exceed. A followup review of the NAS phone problem, identified	B - ACE	Operations Mgr\ Mgmt			
CR-VTY-2004-02006	06/18/2004		FTS-2000 does not work.	C - MPC & CORRECT	E-Plan Mgmt	CONT-RM-272	BLD	
CR-VTY-2004-02007	06/18/2004		JDDG power cycling between emergency and alternate on a 3 minute cycle post scram/fire on 6/18/04	B - ACE	Eng SYS System Eng Mgmt	DG-3-1A	SEC	
CR-VTY-2004-02008	06/18/2004		A positive ground developed on DC-1 post scram/fire on 6/18/04	C - MPC & CORRECT	Eng SYS System Elec Mgmt	DC-1	125D	
CR-VTY-2004-02009	06/18/2004	07/02/2004	Instrument AC was lost during the scram/fire on 6/18/04	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	ATS-IAC	240A	
CR-VTY-2004-02010	06/18/2004	06/30/2004	Blown fuses The running mg lube oil pumps for the recirc mg sets p-77-1A,B,D,E blew their fuses during the scram/fire on 6/18/04	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	P-77-1A	MGLO	
CR-VTY-2004-02011	06/18/2004		Main transformer hi pressure Main transformer has a high pressure trip locked in post scram/firre on 6/18/04 preventing restoration of 345KV ring bus	C - MPC & CORRECT	Eng SUP Project Mgmt	T-1-1A ABB	345K	X
CR-VTY-2004-02012	06/18/2004	07/12/2004	South SDV not drained alarm Annunicator 5-C-7 (South sdv not drained) will not clear post scram/fire on 6/18/04	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	ANN-9-5	BLD	
CR-VTY-2004-02015	06/18/2004		Reactor Scram At 06:40 on 06/18/2004 a reactor scram occurred due to an apparent fault some where in the 22 KV iso-phase bus duct system. The plant is shutdown. Initial indications are that all safety systems responded as designed. There are no operability concerns related to safety related equipment at this time. Various non-safety related plant equipment experienced damage. All equipment	A - RCA & CARB	Eng Power Uprate Mgr\ Mgmt			X
CR-VTY-2004-02016	06/18/2004		OP 3542 not entered as required. The TSC Coordinator did not enter OP 3542 per procedure requirements during the UE on 6/18/2004. The TSC Coordinator did not contact the Control Room and this step (1.24) is NA'd in the Control Room Procedure. Not entering OP 3542 led to delays in event termination.	C - MPC & CORRECT	E-Plan Mgmt			
CR-VTY-2004-02017	06/18/2004	06/21/2004	Notification of Unusual Event (NOUE) Declared Due to Plant Fire and Automatic Reactor Scram A NOUE was declared due to a fire in the Iso Phase Bus Ductwork to the Main Transformer that resulted in a Main Generator trip and	D - ADMIN CLOSURE	Eng Power Uprate Mgr\ Mgmt	22KV	22KV	X
CR-VTY-2004-02018	06/18/2004	06/19/2004	Mechanical Vacuum Pump suction valve would not open following the scram Following the scram/Main transformer trip, the mechanical vacuum pump was being placed in service to maintain vacuum. The Suction valve would not open when attempted until the Gr 3 isolation was reset. I believe this was related to the	D - ADMIN CLOSURE	Operations Mgr\ Mgmt	FCV-102-35	AE	
CR-VTY-2004-02019	06/18/2004		Main Transformer Fire On 06/18/2004 at approximately 06:40 an apparent fault occurred in the 22 KV iso-phase bus duct system. As a result a fire was started in the main transformer. The fire brigade was activated and off-site fire resources were requested. An Unusual Event was declared. Automatic deluge systems	C - MPC & CORRECT	Operations Mgr\ Mgmt	T-1-1A ABB	345K	X
CR-VTY-2004-02020	06/18/2004	07/02/2004	C Air compressor tripped after the scram/main transformer trip After the scram/transformer trip, it was observed that the C air compressor had tripped and would not restart until after the breaker was reset. I believe it was due to a	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	C-1-1C	SA	

ATTACHMENT 18
CR-VTY- 2004-2015
Related Condition Reports

CR-VTY-2004-02021	06/18/2004	07/06/2004	Both Reactor Recirc MG set trip on the reactor scram. The trip of the Reactor Recirc mg set may have been caused by blown control power fused to all teh Recirc MG set lube oil pumps.	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	MG-1-1A MG-1-1B	NB NB	X
CR-VTY-2004-02022	06/18/2004		Discrepancy in Post Scram Rod Position (PSRP) indication Following a scram on 06/18/04 the STA checked the PSRP screen. He noted that the screen displayed YES for three questions related to all rods in, all rods > 02, etc. Following the scram at some later time, the senior resident inspector noted that two rods indicated they were at position 02 on the PSRP screen. The full core display	C - MPC & CORRECT	Tech Reactor Mgmt	950-10	MC	
CR-VTY-2004-02023	06/18/2004	07/06/2004	Torus to Drywell Vacuum Breaker indicating lights and alarm indicate breakers may have cycled during the scram/transformer trip Following the scram/transformer trip, it was observed that the vacuum breaker indicating lights in the reactor building were extinguished. The control room recieved the vacuum	C - MPC & CORRECT	Eng DE Elect I&C Mgmt			
CR-VTY-2004-02024	06/18/2004	07/02/2004	The "B" Feed Water Reg valve locked up at the time of the reactor scram. The "B" Feed Water Reg Valve lockup indicating light was lite.	C - MPC & CORRECT	Eng SYS System Eng Mgmt	V63-21B FCV-6-12B	FDW FDW	
CR-VTY-2004-02025	06/18/2004	07/06/2004	AOG recombiner isolated/OG-516B isolated when the plant scrammed on the transformer trip The AOG system isolated with multiple alarms and the OG 516 valve isolated closed when the plant scrammed on the Main Transformer trip. It may have been caused by the loss of instrument AC at the time of the trip.	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	PCV-OG-516B	AOG	
CR-VTY-2004-02027	06/18/2004		Hydrogen fire on H2 Seal Oil Level Detector Following scram and fire in the main transformer a hydrogen fire was detected on the H2 Seal Oil Level detector. The fire brigade responded and the fire was extinguished with a portable fire	C - MPC & CORRECT	Eng SYS System Eng Mgmt	H-58	SO	X
CR-VTY-2004-02029	06/18/2004	06/30/2004	Unexpected annunicator Annunicator 6-M-1 (DCS trouble alarm) is locked in post scram/fire on 6/18/04	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	ANN-9-6	BLD	
CR-VTY-2004-02030	06/18/2004		Offsite Fire Dept Personnel Not Issued Dosimetry per OP 3020 During a fire brigade debriefing session on the 6/18/04 transformer fire it was discussed that incoming offsite fire units were not issued emergency dosimetry packets as per section F. 4 of OP 3020. There is confusion as to exactly if any dosimetry was issued to offsite firefighters as Security personnel report they were directed not to issue the packets as the fire personnel arrived (possibly by the TSC) but subsequently Security delivered some emergency dosimetry packets to an RP rep at the fire scene. The offsite fire brigades have always receieved training that they would be issued emergency dosimetry packets upon arrival per OP 3020.	C - MPC & CORRECT	E-Plan Mgmt			
CR-VTY-2004-02033	06/19/2004	06/21/2004	HPCI GL Seal Cond. Hotwell lvl high Alarm CRP 9-3-U-7, HPCI Gland Seal Cond Hotwell Level High did not actuate when the HPIC gland seal condenser hotwell automatically pumped down due to high level. CWD's indicate that an	D - ADMIN CLOSURE	Operations Mgr\ Mgmt	P-87-1A	HPCI	
CR-VTY-2004-02035	06/19/2004		Local fire department responded with a juvenile fire fighter. During the main transformer fire, the Vernon Fire Department responded inside the Protected Area with one member under the age of 18. The individual was part of the fire explorer program in Vernon. The individual did not access any RCA. Once the	C - MPC & CORRECT	E-Plan Mgmt			
CR-VTY-2004-02036	06/18/2004		Release of Oil Contaminated Water Mixed with Fire Fighting Foam into the Storm Drain System and CT River The purpose of this CR is document clean up activities associated with the main transformer fire as written by Dwight Hensel. A small amount of transformer oil (estimated at <20 gallons) following the main transformer fire entered the storm drain system and the CT River. The water/foam from fire fighting mixed with the transformer oil (Exon Univolt) and entered the storm drains. The storm drains were covered and the storm drain isolation valve (V-Yard-10) was shut as soon as possible after the incident occurred. This caused backing up of contaminate onto the gravel surface and	C - MPC & CORRECT	Tech Chemistry Mgmt			
CR-VTY-2004-02037	06/19/2004	06/24/2004	During the Post Trip Report review of the Alarm Typer, it was observed that the 81-1T breaker indicated that it cycled twice in under a second during the scram. Discussion with S. Gunnip indicate that it is probably an indicator problem vice the an actual cycling of the breaker. The time of occurrence on the typer was	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	81-1T	345K	
CR-VTY-2004-02038	06/19/2004	06/29/2004	Unexpected alarm on the Local A & B EDG's Panels. During the plant transient on June 17, 2004, the Control Room received trouble alarms for both EDG's. An operator was dispatched and both EDG's had F-3 "Loss of 480VAC or 125VDC @ Engine" alarm in on the local panels. The alarm was able to be reset and no flags	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	DG-1-1A-GP DG-1-1B-GP	DG DG	
CR-VTY-2004-02039	06/19/2004		Ground on DC-2 During the plant transient on June 18, 2004, a ground was observed on DC-2. This was identified during a review of the paperwork for the	C - MPC & CORRECT	Eng SYS System Elec Mgmt	DC-2	125D	
CR-VTY-2004-02040	06/19/2004	07/02/2004	First Detector Alarm in the Cable Vault Room At approximately 0905 on June 18, 2004, the Control Room received a First Detector Smoke alarm in the Cable Vault room. No smoke was observed in the CV room, however the Turbine Building was smokey due to the isophase bus fire. The CO2 system was aborted and an hourly fire watch was established.	C - MPC & CORRECT	Safety Mgmt	CP-115-1	FP	
CR-VTY-2004-02041	06/19/2004		Failure of fire brigade radio batteries. During the main transformer fire event, most of the fire brigade portable radio batteries would only last one hour. We do	C - MPC & CORRECT	Safety Mgmt			
CR-VTY-2004-02043	06/20/2004	06/20/2004	FORIGN MATERIAL FOUND IN THE A (ALPHA) PHASE ISOPHASE BUS BY THE GENERATOR LINKS. A SMALL PIECE OF WIRE WAS IDENTIFIED INSIDE OF THE ALUMINUM BUSWORK BY THE MAIN GENERATOR LINKS.	D - ADMIN CLOSURE	Maint Support Mgmt	ISOPHASE-BUS	22KV	X

ATTACHMENT 18
CR-VTY- 2004-2015
Related Condition Reports

CR-VTY-2004-02044	06/20/2004	06/21/2004	Loose Inspection Cover on 'A' Isophase Bus Duct During a plant tour, it was discovered that the bolts for the lower inspection cover (adjacent the exterior of the Turbine Building) for the 'A' Isophase Bus Duct were not tightened. This could have allowed moisture into the duct work, contributing to the transformer fire on 6/18/04. A picture of this cover can be seen at	D - ADMIN CLOSURE	Eng Power Uprate Mgr\ Mgmt	ISOPHASE-BUS	22KV	
CR-VTY-2004-02047	06/20/2004	06/21/2004	Bus Duct internal parts found in Iso Phase Bus Duct near transformer. Part of a lamination for an Iso Phase Bus Duct Expansion Joint was found in the Phase B duct near the Turbine Building Wall. The lamination was located at the 90 degree upturn in the Bus Duct, just past the inspection port. The Expansion Joints are located within the ductwork inside the Turbine Building. There are two joints in each phase of the Iso Phase Duct. One joint is between the fan and the GDS. The other is between the GDS and the Turbine Building Wall. Each of the joints are made up of many layers of lamination. These joints are part of the original design. Bus Duct cooling air is supplied toward the transformer through the Phase B duct, and returns to the cooler through the Phase A & C ducts. The	D - ADMIN CLOSURE	Eng Power Uprate Mgr\ Mgmt	ISOPHASE-BUS	TG 22KV	X
CR-VTY-2004-02050	06/21/2004	07/14/2004	CIT-109-17A OUTPUT RANGE CHANGED FOLLOWING ELECTRICAL TRANSIENT Following Rx/Turbine trip on 6/18/04 CIT-109-17A was noted to have spiked full scale and then went to slightly above zero. Work order 04-2648 found that output scaling had reset to 0 to 19.99 uS. Recorder is scaled 0 to 1 uS. This is the same problem documented in cr's 04-00025 and 04-01940 related	C - MPC & CORRECT	Maint Support Mgmt	CIT-109-17A	SPL	
CR-VTY-2004-02051	06/21/2004		ERFIS data acquistion system (DAS) 'C' reset itself during the scram on 6/18/2004. It was nonfunctional during the reset for ~50 seconds.	B - ACE	Tech Reactor Mgmt			
CR-VTY-2004-02053	06/18/2004		ERFIS Scram Timing Software did not generate CRD Scram Timing Report Following Auto-Scram At 06:40 on 18-Jun-2004, the plant had a full scram as a result of a generator load reject. The plant process computer detected the scram and captured the control rod drive scram timing information as the scram occurred, but the ERFIS software failed to update its own CRD History file with the just acquired scram timing data and it failed to generate the (on demand)	C - MPC & CORRECT	Tech Reactor Mgmt			
CR-VTY-2004-02055	06/21/2004		Low Voltage Alarms received for Buses 1, 2, 3, 4, 8 & 9 During the plant transient on Friday, June 18, 2004, ERFIS low voltage alarms were received for the Buses 1, 2, 3, 4, 8 & 9. Per ERFIS typer the low voltage condition lasted approx. 2 seconds. The low voltage condition may have caused several of the	C - MPC & CORRECT	Eng SYS System Elec Mgmt		4KV 480A	X
CR-VTY-2004-02059	06/20/2004		Generator Leads Cooling Dampers Closed During a plant tour, it was discovered that the manual supply damper, as well as both manual return dampers, in the isophase bus cooling lines to the generator leads cabinet were in the closed position. These dampers are not shown on any drawing that I could find and they are not referenced in the Isolated Phase Bus Cooling Operation Procedure (RP	C - MPC & CORRECT	Operations Mgr\ Mgmt	ISOPHASE-BUS	22KV	
CR-VTY-2004-02070	06/20/2004		PCB contaminates discovered in and area surrounding the "A" isophase PT cabinet TB248 PCB contaminates were discovered in the "A" isophase cabinet and surrounding areas following a fire in the cabinet. The cabinet contained a small capacitor that contained PCB containing oil.	B - ACE	Tech Services Manager			
CR-VTY-2004-02074	06/23/2004		Failure to Make Timely Notification of States upon Declaration of Unusual Event on 6/18/04 An Unusual Event was declared by the VY duty Operations Shift Manager at 06:50 AM on June 18, 2004 under Emergency Action Level (EAL) U-4 a ?Any unplanned onsite or in plant fire not extinguished within 10 minutes? An Operations Shift Manager (OSM) qualified individual (the Asst. Ops Mgr) was assigned by the duty OSM to complete the notification of the UE declaration to the 3 States via the Nuclear Alert System (NAS) phone. This assignment was made because the Duty Shift Technical Advisor (STA) (who would normally make the notification) had left the Control Room to respond to the reported fire as the Plant Fire Brigade Leader (FBL) per OP 3020. The OSM qualified individual completed the required paperwork (VYOPF 3540.06) and had it approved by the	B - RCA & CARB	E-Plan Mgmt			
CR-VTY-2004-02075	06/23/2004		Employees were involved in a fire area clean-up and other recovery activities before it was identified that a PCB containing capacitor had been damaged during the arc/fire event. After the event at the Main Transformer, the general area of the isophase duct area was cleaned of debris, scaffold was built, and other activities were performed before it was identified that a PCB containing capacitor	B - RCA & CARB	General Manager			
CR-VTY-2004-02076	06/23/2004	07/06/2004	"A" & "C" SV High Acoustic Monitor alarm received During the transient on June 18, 2004, the control room received the "A" and "C" Acoustic Monitor High alarms. The alarms were reset by the operators with no discrepancies.	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	SV-70A SV-70C	101	
CR-VTY-2004-02078	06/23/2004		Notification to Wilder Station not made during UE. The SSS missed the step in the OP 3547 to notify Wilder Station of the UE.	C - MPC & CORRECT	E-Plan Mgmt			
CR-VTY-2004-02080	06/23/2004	06/24/2004	RP unable to support scheduled fire drills for use of SCBA During the unannounced fire drill on 6-21-04 and again for the announced drill on 6-22-04 the fire brigade was not allowed to use SCBA due to the inability of the RP department to support restoration of the SCBA after the drill. Prior to the drills the fire brigade instructor contacted the RP supervisor to ensure RP could support the restoration of the SCBA. In both cases RP stated they could not support the	D - ADMIN CLOSURE	PS&O Manager			

ATTACHMENT 18
CR-VTY- 2004-2015
Related Condition Reports

CR-VTY-2004-02081	06/23/2004		Cable C1229C overheated and appears to have arced to ground durng ISO-PHASE bus event. The cable that leaves the surge cubicle is melted at the point of exit from the surge cubicle. The conduit connectors that the cable runs through which connects from the surge cubicle to the neutral transformer appears	C - MPC & CORRECT	Eng SUP Project Mgmt	GEN-NEUT-XFMR	22KV	
CR-VTY-2004-02082	06/23/2004	06/25/2004	Temperature senor on the ISO-PHASE bus was damaged during fire. The Temperature senser TS-108-7C was damaged by the ISO-Phase Bus fire and will	D - ADMIN CLOSURE	Eng SUP Project Mgmt	TS-108-7C	MISC	
CR-VTY-2004-02084	06/24/2004		FME FOUND IN ISOPHASE BUS DUCT COOLERS DURING INTERNAL INSPECTION Internal inspection of the isophase bus cooler was performed to identify any components that may have failed in the cooler and contributed to foreign material in the isophase or any foreign material generated elsewhere that migrated to the cooler. All covers were opened including inspection covers on top of the cooler. Additionally, the bus duct from the A phase bus to the cooler intake section and the duct from cooler fan GLF-1A to the B isophase was removed to facilitate cleaning and inspection. Note that GLF-1A was the fan in operation at the time of the ground fault. The inspection revealed several pieces of foreign material, all in the cooler intake section (from bus phases A and C).	B - ACE	Eng SUP Project Mgmt	ISOPHASE COOLER	22KV	X
CR-VTY-2004-02087	06/24/2004		Off-site Fire Department closed off access road to VY during transformer fire. Fire fighters staged at the Vernon School decided to have local police close off Gov Hunt Road to all vehicle traffic. This effort was not coordinated with the Plant Control Room, or the fire ground incident commander. Shutting down the road prevented VY personnel from accessing the plant during the event. After awhile, police allowed VY personnel to access the plant. Actions like this must be	C - MPC & CORRECT	E-Plan Mgmt			
CR-VTY-2004-02088	06/24/2004	06/25/2004	ARC damage discovered in the Phase B ISOPHASE Duct Outside Turbine Building. Discussion: The ISOPHASE BUS Duct distributes the output of the Generator to the Main and Auxiliary Transformer. There are three ducts, one for each phase. The ISOPHASE Bus Duct consists of a square aluminum bus supported by insulated standoffs inside of a duct. Air is blown through the ductwork to cool the bus. Air is supplied through the Phase B Duct, and returns to the coolers via Phase A & C Ducts. The Bus Duct was damaged by a short and a fire on 06/18/04 (CR-VTY-2004-02015). Problem Statement: Internal inspection of the outside sections of ISOPHASE BUS Duct Phase B showed that there are numerous arc strikes and burn marks on the Bus and corresponding pitting and slag on the Duct walls. The arcing was found on both upstream and down stream	D - ADMIN CLOSURE	Eng Power Uprate Mgrt Mgmt	ISOPHASE-BUS	22KV	X
CR-VTY-2004-02114	06/28/2004	06/29/2004	FME IDENTIFIED IN 'B' PHASE OF THE ISOPHASE BUS DUCT Two small pieces of metal were discovered in the "B" Phase of the ISOPHASE Bus Duct. The material was approximately two feet from the Turbine Building wall inside the duct. The material appeared to be silver in color and was crumpled. The larger piece was approximately 1.5" wide 1/4" wide X 1/8 thick. The smaller piece was	D - ADMIN CLOSURE	Eng SUP Project Mgmt	ISOPHASE-BUS	22KV	X
CR-VTY-2004-02115	06/28/2004		INSPECTION OF AUXILLARY TRANSFORMER HIGH SIDE CABINET REVEALED FOUR (4) POTENTIAL PROBLEMS (see attachment)	C - MPC & CORRECT	Eng SUP Project Mgmt		22KV	
CR-VTY-2004-02117	06/28/2004		Protecto-wire protective outer covering shows signs of scuffing. While inspecting the Protecto-wire (linear fire detection) on the Main Transformer, damage to the protective (weather) outer covering was noticed by at least one of the strap hangers. It appears that the outer covering may have scuffed off due to the strap hanger, exposing the inner metal wire. The system is still considered as operable	C - MPC & CORRECT	Safety Mgmt			
CR-VTY-2004-02118	06/28/2004		Weld wire discovered imbedded in weld seam in ISOPHASE Bus Phase B. During the video survey of The ISOPHASE Ducts conducted on 06/26/04, a piece of weld wire was discovered imbedded in the weld seam inside B Phase duct in the Turbine Building. The wire is located in the section between the GD-1 and the Fan. The wire is on the right side facing the fan approximately 5 ft in from the GD-1 Box. It can be observed from the first top inspection port between the GD-1 and the fan. The wire is imbedded in the weld material. This wire was probably	C - MPC & CORRECT	Eng SUP Project Mgmt	ISOPHASE-BUS	22KV	X
CR-VTY-2004-02124	06/28/2004	07/02/2004	Trip of Station Air Compressors During Plant Scram "A" & "B" Station Air Compressors tripped during plant scram on 18 June 2004 due to electrical	C - MPC & CORRECT	Eng DE Elect I&C Mgmt	C-1-1B C-1-1A	SA SA	
CR-VTY-2004-02125	06/28/2004	06/29/2004	The PLANT SSC has exceeded its Maintenance Rule UCLF criteria. The PLANT SSC has exceeded its Maintenance Rule UCLF criteria due to unplanned losses associated with the 6/18/04 event (CR 2004-2015). This CR has been initiated in	D - ADMIN CLOSURE	Eng SYS System Eng Mgmt			
CR-VTY-2004-02126	06/28/2004	06/29/2004	A lamination was discovered missing from an ISOPHASE Bus Flexible Joint. The ISOPHASE Bus consists of an aluminum bus within a ductwork. The bus is insulated from the duct by insulating standoffs, which support the bus and allow cooling air flow. The bus transfers current from the generator to the transformer. Bus Expansion Joint sections are located within the ductwork inside the Turbine Building. There are two joints segments in each phase of the ISOPHASE Duct. One joint is between the fan and the GDS. The other is between the GDS and the Turbine Building Wall. On Saturday 06/26/04, while inspecting the ISOPHASE Bus "B" Phase flexible joint removed from the Generator Fan End of the bus (Inside Turbine Building), it was noted that one outside joint lamination was missing. There are 22 laminations per joint assembly, with two lamination	D - ADMIN CLOSURE	Eng Power Uprate Mgrt Mgmt	ISOPHASE-BUS	22KV	X

ATTACHMENT 18
CR-VTY- 2004-2015
Related Condition Reports

CR-VTY-2004-02128	06/28/2004		WELDING DISCONTINUITIES NOTED DURING INSPECTION OF REPLACEMENT 22KV ISO PHASE BUSWORK FLEXIBLE CONNECTORS *During a requested inspection of the welding quality of replacement 22KV Iso* Phase Buswork Flexible Connectors, the System Engineering Code Programs NDE Level III identified several conditions which exceeded stated accepance	C - MPC & CORRECT	Eng SUP Project Mgmt	ISOPHASE-BUS	22KV	X
CR-VTY-2004-02134	06/29/2004		Unauthorized Shutdown South end of Governor Hunt Road by Project Engineer during 6/18/04 Fire An e-mail was forwarded to VY E-Plan department by Fire Protection Engineer on 6/28/04 from a VY Project Engineer detailing how he had shutdown the South end of the Govvernor Hunt Ropad during the 6/18/04 fire event between 07:15 and 07:30. Apparently Vernonn PD and VT State Police relieved him at this time. There is already a CR VTY 2004-02087 addressing the shutdown of the road being ordered by one of the responding fire chief's with out contacting the fire command for this incident. This is a separate issue in that we	C - MPC & CORRECT	E-Plan Mgmt			
CR-VTY-2004-02152	06/30/2004		WELD DISCONTINUITY IDENTIFIED ON VERTICAL B PHASE FLEXIBLE CONNECTOR PRIOR TO INSTALLATION During visual inspection of vendor welds on the vertical Iso phase buswork flexible connectors prior to installation, an area of insufficient weld was noted on the B phase flexible connector.	C - MPC & CORRECT	Eng SUP Project Mgmt	ISOPHASE-BUS	22KV	
CR-VTY-2004-02161	07/01/2004	07/02/2004	HVAC and AOG trouble alarm received prior to the scram on June 18, 2004 As a precursor to the scram and isophase bus fire, the Control Room received HVAC and AOG trouble alarms. These alarms came in just prior to the scram. The alarms came in and cleared at 0237 on 6/18/04 for no apparent reason. The day before on 6/17/04 when the Generator Ground Current High alarm was	D - ADMIN CLOSURE	Eng SYS System Eng Mgmt		AOG HVAC	
CR-VTY-2004-02181	07/04/2004	07/06/2004	Found open CT circuit during restoration testing. On 7/3/04 while testing generator CT's (current transformer) circuits, WO # 04-2578-10, an open return circuit was found between terminal points TDN 7 & TDN 12 on CRP-9-22. This is	D - ADMIN CLOSURE	Maint Support Mgmt	EI-9-22-D2B-3F	22KV	
CR-VTY-2004-02183	07/04/2004		*Inadequate OE Response Associated with Surge Arrester and Electrical Bus* Flexible Connector Inspection and Preventive Maintenance/Testing The RCA associated with the plant electrical fault and fire (CR-VTY-2004-2015) identified inadequate OE response as a Contributing Cause (CC-3) to the event. Specifically, response was inadequate relative to: - Recommendations contained in SOER 90-01 - Implementation of preventive maintenance inspections of the 22	C - MPC & CORRECT	*Tech CA&A HU Mgmt*			X
CR-VTY-2004-02187	07/05/2004	07/06/2004	Annunicator 7-E3 locked in 7-E-3 Aux xmfr T-2 temp high was locked in prior to performance of transformer testing	D - ADMIN CLOSURE	Operations Mgr\ Mgmt	T-2-1A	22KV	
CR-VTY-2004-02188	07/05/2004	07/06/2004	Annunicator 7-E-5 locked in Annubicator 7-E-5 Aux xmfer T-2 trouble alarm locked in prior to energizing transformer for testing.	D - ADMIN CLOSURE	Operations Mgr\ Mgmt	T-2-1A	22KV	
CR-VTY-2004-02189	07/05/2004	07/06/2004	Inaccurate Temperature Input to NPDES Monitoring Program. ERFIS computer point F058 is indicating a three degree rise across the 'B' condenser's number one water box, while no heat is being added to the condenser. This point is an input to the plant computer calculation of heat being discharged to the river for Project Save. An erroneously high input from this point will cause unnecessary operation	D - ADMIN CLOSURE	Eng SYS System Eng Mgmt	TE-104-68B-1A	CW	