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BFGoodrich INTER-ORGANIZATION CORRESPONDENCE

To: P. Donataccio, Louisville REDACTED

From: W. G. Russell, Louisville March 20, 1987

Repetitive Accident Type 10-A: Toxic Chemical Release

Summary of The Incident

On Sunday, January 18, 1987, at 1:05 PM, poly 5 in the LPA partially vented to the atmosphere. An estimated range of 5000 to 10,000 pounds of 103EP F-76 resin and 4100 to 8200 pounds of VCM were lost. The incident was reported to the Jefferson County Air Pollution Control District. Ambient VCM levels in the immediate area did not exceed 24 ppm and no prolonged employee exposure occurred. No equipment was damaged.

Board of Review

A Board of Review was held at 8:30 AM on January 19, 1987. This was followed by two emergency back-up systems failure reviews and three separate emergency systems fact finding sessions. A final wrap-up meeting was held at 1:00 PM on February 2, 1987. Those who attended at least one of the meetings included:

E. L. Beeler, Plant Manager
P. Donataccio, Manufacturing Manager, Geon Vinyl Suspension Resin
N. S. Grove, Plant Engineer
R. L. Martin, Manager, Health, Safety & Environmental Services
R. R. Mueller, Plant Controller
M. D. Azzara, Engineering Supervisor - Area 4
M. J. Carmack, Senior Process Engineer
R. L. Feger, Senior Engineer - Electrical
T. C. Patterson, Engineering Supervisor - Area 3
S. T. Brown, Senior Licensing Specialist
S. E. Hale, Senior Production Engineer
W. E. Lawrence, Senior Process Designer
W. G. Russell, Senior Engineer
J. G. Serdenis, Senior Maintenance Engineer
A. D. Simpson, Senior Environmental Engineer
J. W. Chinn, Production Foreman, Water Treatment/Refrigeration
S. A. Deetsch, Engineer (C&IE)
M. T. Grawemeyer, Engineering Foreman
P. E. Sumpter, Engineering Foreman
R. L. Bennett, Production Foreman, LPA
M. D. Lucas, Production Foreman, LPA
M. W. Warfield, Production Foreman, LPA
D. Allen, Electrician
R. Ramsey, Electrician
J. Shields, Electrician
, Chemical Operator, Utilities
Chemical Operator, LPA
Chemical Operator, LPA
Chemical Operator, LPA

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Narrative

The following is a summary of the events that occurred, leading up to, during, and follwing the venting. This summary begins with events which occurred beginning on the 4-12 shift, Saturday night, January 17, 1987.

January 17, 1987 Saturday 4-12 Shift

LPA Shift Foreman: M. Warfield
Plant Electrician:

10:30 PM: A power failure occurred which affected all of Plant I. Power was lost to both phase I & II in the LPA. At this time, the LPA UPS system, computer, VSP air, and LPA radio communications also went down. The LPA foreman was also unable to receive radio communication through the maintenance radio system at this time.

10:31 PM: Both the Phase I & II emergency generators came on and switched on line.

10:36 PM: Plant I power resumed. It was reported that the problem had occurred at LG&E's Grady substation. Polys 2 & 5 were shortstopped. Poly 2 had pressure increase up to 175 psig and poly 5 was near the end of its reaction. All other polys came back under control. At this time VSP air had still not been restored. The emergency air system provided enough air to shortstop poly 5 but the valves had to be manually opened with a wrench to shortstop poly 2.

Under normal circumstances, the B/108 Centac air compressor is the primary source of VSP and instrument air but it was down for the entire weekend for maintenance repairs. The B/108 Atlas and B/115 Joy compressors were providing breathing, instrument, and VSP air for the LPA and the plant. The Atlas compressor is on the Phase II emergency generator and was immediately restarted. The Joy compressor could not be immediately restarted due to ammonia leaks in B/115 which required a Scott Air Pak to enter.

10:45 PM: Mr. Warfield bypassed the UPS system.

11:20 PM: The Joy air compressor was back on line and VSP air pressure was restored.

11:30 PM: By this time the LPA foreman was able to receive maintenance radio communications. The LPA radio system required parts which kept it down the entire weekend. Radios were obtained from the Tank Farm for use in the LPA.

January 18, 1987 Sunday 12-8 Shift

LPA Shift Foreman: M. Lucas
Plant Electrician:

* 12:30 AM: _____ shut down the emergency generators and returned the LPA back to normal power.

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At this time normal operations had been resumed except that the computer was down and the UPS system was still bypassed.

1:00 AM: Mr. M. Carmack, LPA Senior Process Engineer, came in and restored the computer fixed head disk. Computer operations resumed to normal.

2:00 AM: the LPA assigned electrician, came in. He and Mr. Shields replaced the inverter breaker which had blown on the UPS system.

3:00 AM: At this time all operations were back to normal.

January 18, 1987 Sunday 8-4 Shift

LPA Shift Foreman: R. Bennett
LPA Control Room Operator:
LPA Poly Operator:
LPA Dryer Operator:
LPA Pigment Operator:
Plant Electrician: D. Allen

12:50 PM: Lost all Plant I power. Both cables from the LG&E's Grady substation were down. LG&E later confirmed that an under frequency load shedding device had tripped. This had also caused the Saturday night power failure. This device had just been put back in service Friday, January 16, 1987. It had previously been out of service since June, 1986, when a similar power failure occurred. Before putting this device back in service, it was tested but no reason for the failures could be determined. The device was taken back out of service Sunday.

When the power failure occurred, VSP air, the same UPS breaker, the computer, all setpoints, and all indicators were lost. Mr. Bennett contacted Mr. Allen for assistance.

12:51 PM: Mr. Bennett went to the emergency generators and visually observed by the smoke coming from the stacks that both emergency generators had come on. Only the Phase I generator switched to provide power. No power to Phase II was restored. Phase I poly agitators and oil pumps came on as indicated by the indicator lights but no amp, temperature, or pressure readings were restored.

12:55 PM: Mr. Bennett checked LPA subs. Both bus-tie and main were open on Phase I. On Phase II, the main was closed but the bus-tie was opened.

1:00 PM - 1:01:30 PM: Phase II power resumed. Emergency generator never switched over. The Atlas air compressor was restarted but it did not pressure up.

proceeded to B/152 to start up cooling and refrigeration systems. Mr. Inghram went to the top of the polys. He first checked Phase I poly pressure gauges. All were about 100 psig. He then checked the Phase II polys . Poly 4 was at 100 psig, poly 5 at 200 psig and poly 6 at 150 psig. He radioed to the control room that poly 5 needed to be shortstopped.

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1:02 PM: had to manually open VSP-19, the shortstop valve to poly 5, with channel locks. started the shortstop pump but had no indication of flow. Mr. Bennett checked the shortstop system visually. Everything seemed to be operating. Mr. Bennett had Mr. York place VSP-4 and VSP-5, the recovery valves for poly 5, in the open position. Poly 5 received three minutes of shortstop.

1:05 PM: Poly 5 relief valve discharged for 1-2 minutes. Pressure was at 250 psig as viewed by VSP-4 opened with VSP air but VSP-5 would not open, even with a pipe wrench. Mr. Bennett opened VSP-6 and equipment recovery valve on the Phase I poly recovery separator with a pipe wrench to vent pressure from poly 5. Shortly after VSP-6 was opened, poly 5 quit relieving. The poly relieved in a southerly direction toward Plant III. GC readings in the poly building never exceeded 24 ppm. The GC alarms went off as designed. No equipment was damaged. One B/108 operator who was near the gate to Plant III received a slight dusting of resin.

Polys 6, 3, 1, 2 & 4 were then shortstopped in that order. Poly 1 was partially charged and polys 2 & 4 had already completed their reactions.

1:10 PM: Mr. Bennett bypassed the UPS system. This restored setpoints and indicators. Also started ventilation fans in poly building.

1:15 PM: B/115 Joy air compressor was restarted.

1:20 PM: VSP air had been restored. Started recovery of poly 5. Mr. Bennett visually checked equipment and resin venting.

1:33 PM: Mr. Bennett called Mr. P. Donataccio, Manufacturing Manager, Geon Vinyl Suspension Resin. After informing Mr. Donataccio of the incident, Mr. Bennett called Mr. R. Martin, Manager, Health, Safety & Environmental Services, but did not get an answer.

1:45 PM: Mr. Bennett called and informed the following of the incident: Mrs. A. Simpson, Senior Environmental Engineer; the guard at the gate house; and Mr. P. Sumpter, Engineering Foreman. The guard called 911 to report the incident to civil authorities.

2:00 PM: Mr. P. Donataccio arrived in the plant. Louisville Fire Department arrived. Mr. Donataccio and the District Fire Chief inspected the incident area together. Lake Dreamland Fire Department arrived and also inspected the area.

2:55 PM: Fire departments left plant. Mrs. Simpson, police and MSD arrived in plant. Mrs. Simpson talked to police and MSD.

3:00 PM: Mr. Sumpter arrived in plant.

3:05 PM: Police and MSD left plant. Mr. S. Brown, Senior Licensing Specialist, arrived in plant. He and Mrs. Simpson attempted to determine venting losses. The loss estimate was 4100-8200 pounds of VCM and 5000-10,000 pounds of resin.

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Mr. Sumpter began to check out system. Phase I was still on emergency generator. Phase II was on normal power. Phase II generator breaker control switch was in manual position which prevented Phase II emergency generator power from coming on line. Mr. Sumpter called LG&E emergency number to obtain power status.

Mr. Sumpter checked UPS system. Phase I was okay, Phase II was tripped. Same inverter breaker was tripped. Battery switch was on. UPS bypass indicator lights were not working.

January 18, 1987 Sunday 4-12 Shift

LPA Shift Foreman: M. Warfield
Plant Electrician:

5:00 PM: Mr. Carmack arrived in plant. He restored lost data on computer solid state disk. Computer back on line.

Mr. Sumpter & shut down Phase II generator. After replacing bulbs on indicators for incoming power sync and breaker, they shut down Phase I generator and switched to normal power. No problems were experienced. UPS system would still not reset.

6:00 PM: UPS invertor breaker finally reset. Same breaker as installed Saturday night. UPS back on line. The contents of polys 3, 5 & 6 were pumped out to blowdown tank TK-6G and dried out into TK-10K.

Conclusions

1. Poly 5 vented due to high pressure which resulted from loss of agitation for about ten minutes.

(2). The venting almostly certainly would have been prevented if failures were not experienced with three major emergency backup systems: 1) Phase II emergency power supply; 2) UPS system; and 3) the emergency VSP air system. Since enough time may have been gained to prevent the release if any one of these systems had not failed, each system will be discussed separately in the attachments.

Management System Investigation

Management has extensively tried to provide adequate safeguards to prevent a poly from venting to the atmosphere. Emergency generators were provided to supply adequate electric power to safe-out the process in the event of a power failure. A battery supplied UPS system was provided to supply power to the computer and controllers in case of power interruptions. An emergency air system was provided to supply air to the VSP air system in case plant compressor air was lost. Either human error due to lack of familiarity with the equipment, equipment malfunction, or insufficient capacity of the system, prevented each one of the systems from operating as designed.

Corrective Action

1. This incident will be reviewed with all LPA personnel. Responsibility - S. E. Hale by 2/28/87.

2. General Notice EV-7 "Report of Unusual Discharges" will be reviewed with all LPA foremen. Responsibility - S. E. Hale by 2/28/87.

3. Emergency procedures will be reviewed with all LPA operators and foremen. Responsibility - S. E. Hale by 2/28/87.

W. G. Russell

dlm

Corporate Dist.

G. F. Lefebvre/W. C. Holbrook
H. Waltemate
N. R. Aquino/R. C. Kaminski/E. C. Martinelli
J. A. Kingma/G. E. Higby - Akron Chemical
R. A. Accarino/W. E. Horton - Avon Lake General
R. M. Kreager/R. Kissling - Avon Lake Technical
R. D. Hardesty/S. C. Alten - Avon Lake Technical
M. S. Fox/S. R. Guidry - Calvert City
J. L. Miller/W. C. Fultz - Deer Park
D. Dargan - Hattiesburg
K. J. Willings/R. J. Grahek - Henry
R. W. Taylor/L. V. Goode - LaPorte
W. L. Smith/P. W. Shore - Long Beach
R. L. Martin/R. R. Mueller - Louisville
J. Nagy/J. J. Dunn - Niagara Falls
G. A. Kaswell/R. V. Tebbutt - Pedricktown
T. J. Guillot/C. Bayard - Plaquemine
D. LeBlanc/J. B. Canella - Shawinigan
G. Morley/D. D. Quester - Altona, via Cleveland Safety
R. Goodman/A. Auvil - Beltsville
T. Fletcher/C. C. Lee - Scotford
P. Selvage/H. J. Kletke - Terre Haute

Local Dist.

M. D. Azzara
P. N. Bradford
R. H. Coon
P. Donataccio
L. A. Grady
N. S. Grove
D. C. Hicks
R. S. Kinnamon
U. Kulkarni
G. M. Ladzun
G. J. Lynch
T. C. Patterson
W. G. Pop
P. H. Reger
J. W. Robben
F. M. Schuler
A. D. Simpson
W. T. Simpson
R. E. Tarlton
H. L. Weedman
Plant Protection

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Attachment I -- LPA Phase II Generator Failure

Facts Surrounding the Case

1. The plant experienced a power failure of LG&E cables, Grady 1465 and 1466 on Saturday, January 17, 1987, at approximately 10:30 PM and again on Sunday, January 18, 1987, at approximately 12:50 PM. The failures were due to the operation of an under-frequency load shedding device at the Grady Substation. The reason the device operated has not been determined. According to Mr. Chuck Randal at LG&E, the device had been out of service since a similar occurrence on Friday, June 6, 1986, and was put back in service on Friday, January 16, 1987. The device is now out of service.

2. The Phase I and II generators started and come on line properly during the power failure on Saturday, January 17, 1987. LG&E power was restored about six minutes later.

3. On Sunday, January 18, 1987, at about 12:30 AM, the 12-8 shift electricain, paralleled the Phase I generator with LG&E power, shed the generator load, shut down the generator, and returned Phase I power to normal.

4. The LPA Production Foreman, Mitch Lucas, witnessed operating the generator. After the generator was shut down, Mr. Lucas returned to the LPA control room to see that conditions were normal.

(5) Directly after returning the Phase I power to normal, went to the Phase II generator where he paralleled the Phase II generator with LG&E power, shed the generator load, and shut down the generator.

6. Mr. Lucas did not witness operating the generator.

(7). No one checked that the generator controls had been properly set up for automatic operation.

8. On Sunday, January 18, 1987, at approximately 12:50 PM, the plant experienced the second power failure. The Phase I generator started and came on line properly. The Phase II generator started but did not come on line. The substation 150-NE main breaker did not open and the generator breaker did not close.

9. The 8-4 shift electrician, proceeded to substation 150-NE, and saw that the substation main breaker was closed. had decided to put the Phase II generator on line by opening the substation main breaker and closing the generator breaker. Without realizing that LG&E had restored power, opened the substation main breaker at the substation. then noted that the substation volt meters were indicating proper voltage and realized that LG&E had restored power. He then closed the substation main breaker to regain normal power.

10. operated the substation main breaker using the control switch in the substation. This switch will only operate when the "breaker control" switch at the generator is in the "MANUAL" position. had not operated any switches at the generator.

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11. stated that he had not been trained on the generator operation for about three years. He was hired on June 18, 1984, and was trained on the generator before being assigned shift duties three months later.

12. could not remember the last time he was trained on the generator. He did state that it had been some years ago.

13. There is no training program in place to refresh the electricians on operation of the emergency generator.

14. Operating instructions are readable and in place in each generator. See attached procedure.

15. Placing the breaker control switch in the "AUTO" position is the last step in the generator procedure to "Return to Normal Power With No Break in Load".

16. The generator breaker control switch does not point the same direction in both generators for "AUTO" control. Both switches are properly identified with "AUTO" and "MANUAL" positions clearly marked.

Conclusion

The Phase II generator did not come on line due to the breaker control switch being set to the "MANUAL" position versus the "AUTO" position.

Corrective Action

A. Training Responsibility - T. C. Patterson by 3/31/87

1. All shift electricians will receive quarterly and yearly operational training on the generator. The quarterly training will consist of procedure and equipment familiarization. In the annual training the electrician will actually put the generator on line and return it to a normal power line up.

2. All LPA foremen will receive semi-annual training on generator operation to maintain a familiarization of the equipment.

3. All electricians will receive yearly training on generator operation to maintain a familiarization of the equipment.

B. System Improvements

1. Install an indicator light for each generator in the LPA control room to show that the generator is set up for proper automatic operation. Responsibility -- R. L. Feger by 6/30/87.

2. Modify the breaker control switch "AUTO-MANUAL" position so that the switches in both generators point the same direction for "AUTO" operation. Responsibility -- R. L. Feger by 6/30/87.

3. Set procedures to ensure that the shift electrician contacts an electrical supervisor on all power failures before production is permitted to return to normal operations in the affected areas. Responsibility - N. S. Grove by 2/7/87.

4. L.G.& E. will be contacted concerning the reliability of the power to the plant. Responsibility - N. S. Grove by 2/28/87

ROUTINE NO-LOAD TEST

1. Turn breaker control (manual/automatic) switch to manual position.
2. Turn electrostart switch (clockwise) to test position. (Unit will start).
3. Check frequency adjust to 60 Hz and check generator voltage adjust to 600 volts.
4. Allow unit to run approximately 30 minutes.

RETURN TO STANDBY OPERATION

1. Turn electrostart switch (counter clockwise) to off position.
2. Allow unit to come to a COMPLETE STOP.
3. Turn electrostart switch (clockwise) to automatic position.
4. Turn breaker control (manual/automatic) switch to automatic position.

POWER FAILURE

WHEN SUBSTATION POWER FAILS, THE UNIT WILL START IN 80 SECONDS (ORD SETTING). SUBSTATION BREAKER (CB-1) WILL TRIP TO THE OPEN POSITION. GENERATOR BREAKER (CB-3) WILL CLOSE, ASSUMING THE LOAD.

THE UNIT WILL START ONLY WHEN POWER IS LOST TO THE SUPPLY SIDE OF THE SUBSTATION MAIN CIRCUIT BREAKER. IF ONLY THE SUBSTATION MAIN CIRCUIT BREAKER OPENS, THE GENERATOR WILL NOT START.

ROUTINE LOAD TEST

1. Turn breaker control (manual/automatic) switch to manual position.
2. Turn electrostart switch clockwise to test position. Unit will start.
3. Turn synchronizing (unit/parallel) switch to parallel position.
4. Adjust generator voltage control to match substation voltage.
5. Adjust generator frequency control to match substation frequency (approximately 60 Hz). This will be indicated by the synchronizing lights cycling on and off slowly.
6. Note substation amperage.
7. When synchronizing lights are out depress generator breaker (CB-3) close button. Hold until circuit breaker closes (red light).

   NOTE: If amperage on generator amp meter increases and amperage on substation does not decrease (circulating current) lower generator voltage control, until substation amperage drops.

8. Increase generator frequency control (raise) until generator assumes load, as indicated by generator amp meter indicating initial substation amperage.

   NOTE: If generator does not assume load, the generator voltage might have to be increased to get generator to assume load.

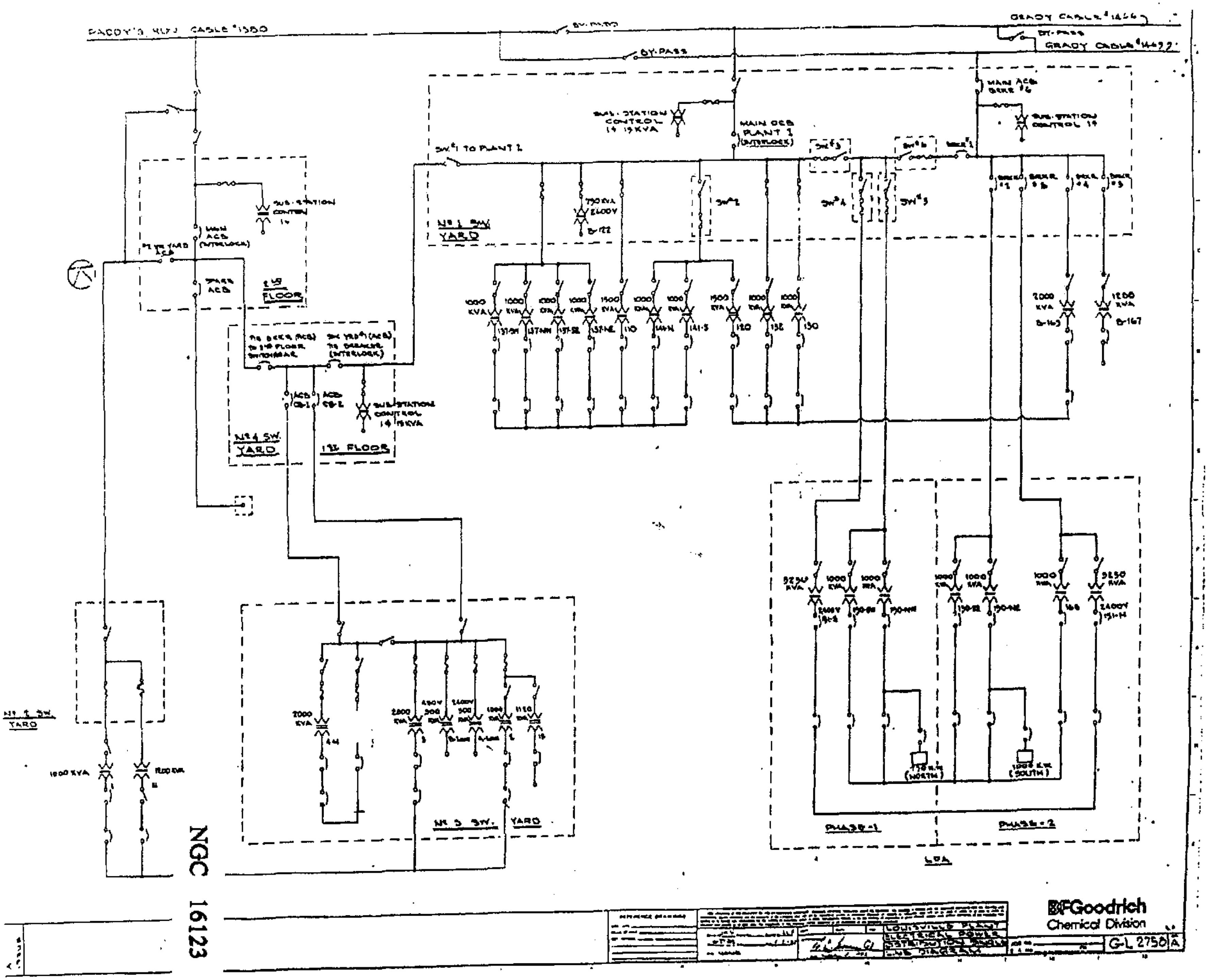
9. When substation amp meter shows low amperage (100 amps or less) depress sub-main (CB-1) open button until sub-main (CB-1) opens (green light).
10. Turn synchronizing (unit/parallel) switch to unit.
11. Adjust frequency to 60 hertz.
12. Adjust voltage to 600 volts.

RETURN TO NORMAL POWER WITH NO BREAK IN LOAD

1. Turn breaker control (manual/automatic) switch to manual position.
2. Turn synchronizing (unit/parallel) switch to parallel position.
3. Adjust generator voltage control to match substation voltage.
4. Adjust generator frequency control to match substation frequency (approximately 60 Hz). This will be indicated by synchronizing lights cycling on and off, slowly.
5. When synchronizing lights are out depress substation breaker (CB-1) close button. Hold in until substation breaker (CB-1) closes (red light).
6. Adjust generator frequency control (lower) until generator amp meter shows low amperage (100 amps or less).

   NOTE: If amperage on substation amp meter increases and amperage on generator does not decrease (circulating current) lower generator voltage control until generator amperage drops.

7. Depress generator breaker (CB-3) open button. Hold in until generator breaker (CB-3) opens (green light).
8. Turn synchronizing (unit/parallel) switch to unit position.
9. Allow generator to run "no load" for two minutes.
10. Stop generator by turning electrostart switch (counter clockwise) to off position.
11. Allow generator to come to a complete STOP.
12. Turn electrostart switch (clockwise) to automatic position.
13. Turn breaker control (manual/automatic) switch to automatic position.



GRADY CABLE #1444
GRADY CABLE #1443
BY-PASS
MAIN OCB PLANT 1 (INTERLOCK)
SUB-STATION CONTROL 14 15KVA
SW#1 TO PLANT 2
Nº 1 SW. YARD
Nº 4 SW. YARD
1ST FLOOR
1ST FLOOR
Nº 5 SW. YARD
Nº 2 SW. YARD
PHASE-1
PHASE-2
LPA
BFGoodrich
Chemical Division
G-L 2750 A

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Attachment 2 - UPS System Failure

Facts Surrounding the Case

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1. Immediately upon experiencing the first power failure at about 10:30 PM on January 17, 1987, the 10KVa Cyberex UPS system failed. The inverter breaker tripped out and could not be reset. This particular breaker had a worn trip mechanism which was discovered in May, 1986. The inverter breaker is a special, long delivery item and one was put on order in May, 1986. The trip mechanism was adjusted to make it functional and the inverter breaker was reinstalled to get the UPS on line. The new breaker arrived in September or October of 1986. It was not installed because the old breaker was functioning properly. The new inverter breaker was installed at about 2:00 AM on Sunday, January 18, 1987. The old breaker was bench checked on Monday, January 19, 1987, and found to be in perfect working order.

2. The UPS system again failed due to the same inverter breaker tripping when the second power failure occurred at 12:50 PM.

3. The Cyberex UPS unit is designed for 30 minute battery back-up. Electrician had checked the fluid level in the UPS batteries on Thursday, January 15, 1987. The level was normal and 19 of the 20 batteries were fully charged. The twentieth was just over "full charge".

4. On Monday, January 19, 1987, again checked the fluid level for the same batteries. All were very low. This is an indication that the batteries were discharged.

5. The recharge time for a wet cell battery is quite long and is probably in the neighborhood of 10-15 hours. The DC inverter/UPS breaker will drop off line when the batteries are not sufficiently charged to protect the batteries.

6. Reliability of the current UPS cannot be guaranteed because of circuit boards which have been overheated due to inadequate cooling in the UPS room. It is common for the UPS to be overheated in the warmer months because of the inadequate cooling. Cyberex Service representative Jim Yeagley said the unit was functioning properly during his August, 1986 visit but that there was no guarantee on how long this would continue because of the overheated circuit boards. This was reviewed within plant management and it was decided to purchase a new, larger capacity unit rather than completely repair the old unit which has marginal capacity. There is an approved AR to buy a new UPS and provide a proper HVAC system for the room.

Conclusions

(1) The inverter breaker dropped out Sunday because the batteries were depleted. It could not be reset until 6:00 PM on Sunday due to the same reason.

(2) The current batteries are either defective and will not carry a load, or were not sufficiently charged to provide effective UPS back-up at the time of Sunday's power failure.

Corrective Actions

1. Pursue AR and have new UPS system installed as soon as possible. Responsibility -- S. A. Deetsch by 4/15/87.

2. Provide adequate training of electricians and LPA foremen on new UPS unit when installed. Responsibility -- T. C. Patterson by 5/30/87.

3. Establish operating procedure for new UPS unit. Incorporate in this procedure that the batteries must be fully charged before resuming charging following a power failure. Responsibility -- S. E. Hale by 4/15/87.

4. Since current condition of batteries is highly suspect, establish temporary procedure that the first step following a UPS failure is to manually bypass the UPS unit. This will provide power to controllers and the computer if either Phase I or Phase II power is available. Responsibility -- S. E. Hale by 1/20/87.

5. Provide battery condition indicators. Responsibility -- S. A. Deetsch by 4/15/87.

6. Establish condition of present batteries. Responsibility -- S. A. Deetsch by 2/3/87. See attached memo from S. A. Deetsch entitled "Exide Serviceman Inspection of UPS Batteries".

BFGoodrich INTER-ORGANIZATION CORRESPONDENCE

TO Memo: For the Record | FIELD POINT OR DEPT. & BLDG. NO. | DATE YOUR LETTER

FROM Steve Deetsch | FIELD POINT OR DEPT. & BLDG. NO. | DATE THIS LETTER 2-5-87

SUBJECT

Exide Serviceman Inspection of UPS Batteries REDACTED

At my request an Exide serviceman, Greg Shopmeyer, inspected our battery system which supports the LPA 10 kw UPS system located on the second floor of Building 127. He is to submit a report of his findings at a later date. This memo will serve to record my understanding of his findings and issues that I feel are pertinent to the most recent "failure" of the UPS system.

Mr. Shopmeyer inspected the batteries visually, took total voltage readings, selected all voltage readings and specific gravity readings. In general, he stated that the batteries were in poor condition and probably should be replaced were it not for our anticipated purchase of a new UPS in the near future. Replacement batteries would not be received any sooner than our new UPS.

Mr. Shopmeyer estimated that the UPS might contain adequate power for 5-10 minutes under load. The batteries are considered to be fully discharged when each cell drops to 1.07 volts for a total of 102 VDC for the total number of 60 cells. The readings taken by Mr. Shopmeyer were 131 volts in float condition and 140 volts in equalize condition. Float voltage was 2.20/cell, equalize voltage 2.35/cell and S.G. was 1200 to 1205 at an electrolyte temperature of 95°F. The fact that the electrolyte temperature was high compared to the recommended 77°F and the ambient temperature exceed 95°F has probably contributed to significantly shorter battery life. A load test should be made the next time LPA is down. This will determine the actual capacity of the batteries under actual load conditions.

Mr. Shopmeyer also re-torqued several terminals that appeared to be loose. He said that we should keep some spare connecting straps on hand for the future. Torquing of the terminals should be done periodically.

Mr. Shopmeyer pointed out that there is a phenomenon called "stratification" that occurs when the unit has not been equalized periodically. Stratification is the layering of different density liquids in the cell. Generally, the acid having the higher specific gravity sinks to the bottom of a battery cell. Other layers could be reversed with respect to S.G. with some of the denser material rising to the top. When this occurs erroneous readings could occur on the S.G. test. In order to prevent this from occurring, the UPS should be set to "equalize" charging mode and allowed to charge for three or four days, 2 or 3 times per year. Black deposits will appear in the bottom of the cell after equalizing has taken place. This is normal and to be expected. Area 3 maintenance electrician, stated that as far as he was aware the UPS had never been charged on equalize. The serviceman said that this appeared to be confirmed by the small amount of black deposits in the bottom of cells.