

NARRATIVE REPORT - TOXIC CHEMICAL RELEASE (VINYL CHLORIDE) - (continued)

Page 2.

was then reopened and the contents of the line pushed back into the polymerizer with steam pressure. The 1/2" bleed off valve was also opened to ensure steam flow.

The "all-clear" was sounded at 0445 hours. Total elapsed time of the gas alarm was fifteen (15) minutes.

FACTS SURROUNDING THE INCIDENT: (REFER TO ATTACHED DRAWING)

1. Poly #20 had been entered for chipping late on the 3-11 shift, October 23, 1980. At this time the steam supply line was secured in a double block and bleed arrangement. Also, up to this point, the poly entry check sheet had been followed. *If the steam valves are air operated, is the air disconnected for entry?*
2. Poly #20 was placed back in service early on the 11-7 shift October 24, 1980 by relief operators, Mr. It was at this time poly entry check sheet had not been followed.
3. Because of miscommunications between the two operators, the polymerizer bottom valves were not set back up properly for the polymerizer to be placed in service: 1) the main steam supply valve was left closed, 2) the 1/2" bleed valve was inadvertently left open.
4. The pearl charge operator, Mr. , did not inspect the bottom side of the polymerizer for proper set-up prior to pulling vacuum as per the charging procedure. Also, the poly entry check sheet had not been initialed by Mr. indicating he had accepted the poly for charging.

MANAGEMENT SYSTEMS INVESTIGATION:

1. Poly entry requires the written approval of the production supervisor (for maintenance) or the charge operator (for production). However, setting up and charging a poly does not normally require direct supervision since a poly entry check sheet is routinely utilized. The utilization of this check sheet for returning the poly to active service had not been adequately emphasized to the operators and supervisors.
2. The new formal training program for all operators had been developed since 6/30/80, but the program had not been completely executed since production came back on stream earlier than planned in September, 1980. The formal training program includes a thorough and detailed review and comprehension of all operating and safety procedures. All new operators had received on-the-job training with an experienced operator for two weeks and were considered qualified to operate using previous training requirements. Operators involved were scheduled to receive the exclusive formal training beginning the next week after the incident. Three (3) separate enrollment changes within five (5) weeks had emphasized an abnormal training debt.

NGC 01425

NARRATIVE REPORT - TOXIC CHEMICAL RELEASE (VINYL CHLORIDE) - (continued)

Page 3.

CORRECTIVE ACTION:

all 3, I hope.

1. Disciplinary counseling will be conducted with the personnel involved, using Interaction Management guidelines. K. E. Musselman, J. V. Nordmeyer
2. Have maintenance inspect the Bendix 7000 floor monitor. High readings were being obtained on the building ventilation inlet which is located south of the building, whereas the wind was blowing south to north and the gas release occurred in the north end of the building. K.D. Konter
3. Review the polymerizer set-up procedure with all polymerizer operators to insure compliance. T. J. Spees, J. C. Schaefer
4. Continue to implement the formal training program for all new and old operators. D. E. Giffin, K. E. Musselman
5. Review the gas alarm procedure with all individuals at the next safety meeting. During the alarm, some individuals reported to the wrong location and several minor communication problems existed. Production Supervisors
6. Modify the poly entry check sheet to insure that the air line to the S2 Fetterolf air valve is closed prior to entry. If this valve had been closed, no emission would have resulted in spite of the miscommunication. R. C. Linneman, K. E. Musselman

what does this impact?

J. V. Nordmeyer

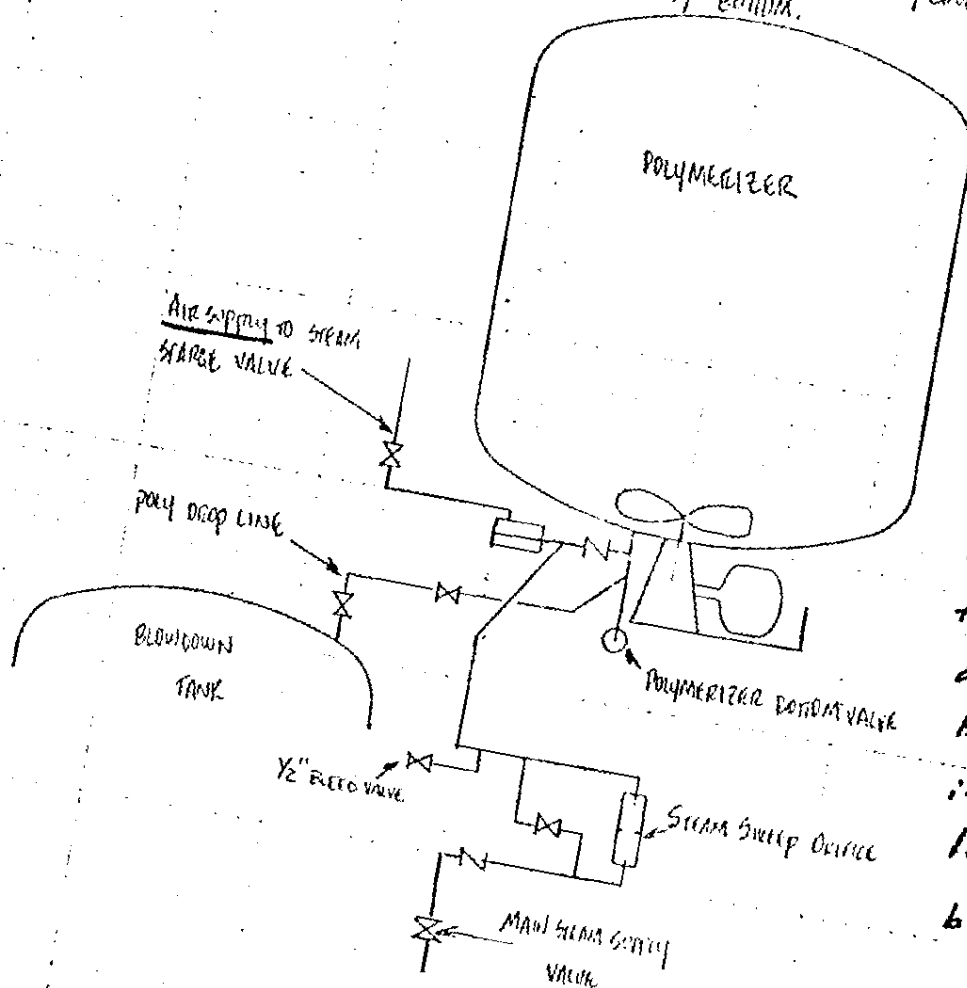
JVN:sfm

cc: See Distribution

NGC 01426

BFGOODRICH CHEMICAL
- SUSPENSION RESIN POLYMERIZER -
HENRY, ILLINOIS

ARRANGEMENT OF STEAM & SLURRY LINES
ON POLY. BOTTOM.



I'm interested
in learning the
position of all
these valves
during entry.
How do they
isolate the ste
line and t
blowdown line.
g.w.ale

JW
11/7/80

NGC 01427

TO	J. D. Krumholz	FIELD POINT OR DEPT. & BLDG. NO. Henry Plant	DATE YOUR LETTER
OM	J. V. Nordmeyer	FIELD POINT OR DEPT. & BLDG. NO. Henry Plant - Suspension	DATE THIS LETTER 12/30/80

SUBJECT

REPETITIVE ACCIDENT NO. 10-A TOXIC CHEMICAL RELEASE (VINYL CHLORIDE)
INCIDENT OF EXPERIENCE VALUE

10A-21

SUMMARY:

On December 19, 1980 at approximately 1540 hours, vinyl chloride gas was found escaping from a three (3) inch hose attached to the drain line from the blending resin recovery knockout tank on the mezzanine. The gas alarm was sounded and the building evacuated. Operator Foreman Campbell re-entered the building with Scott Air Paks, secured the leak and disposed of the frozen vinyl chloride and water that had accumulated. At 1635 the "all-clear" was sounded. There were no injuries or apparent equipment damage as a result of this gas release. Vinyl chloride exposure to personnel was minimal.

BOARD OF REVIEW:

A Board of Review was held at 1400 hours on December 22, 1980 to review the incident. The following personnel were present:

L. V. Goode	- Facility Manager
D. E. Giffin	- Acting Manufacturing Manager - PVC
W. A. Edwards	- Lo-Sope Technical Specialist
A. W. Otto	- Manager - Professional Services
J. D. Krumholz	- Sr. Safety Engineer
M. W. Reynolds	- Environmental Engineer
D. G. Friesz	- Associate Environmental Engineer
---	- Lo-Sope Technician
K. M. Campbell	- Shift Supervisor
	- Lo-Sope/Blending Resin Operator
	- Polymerization Charge Operator
J. V. Nordmeyer	- Acting General Foreman - Poly Building

NARRATIVE:

On December 19, 1980, vinyl chloride gas was found escaping from a three (3) inch hose connected to the blending resin recovery knock-out tank drain line by Lo-Sope/Blending Resin Operator, who sounded the gas alarm. The Polymerizer Building was evacuated.

Mr. Campbell and Mr. Nordmeyer, who were in the personnel office at the time of the alarm, met four (4) Polymerizer Building operators at the southeast corner of the building. After discussing the situation with Operator and Operator Foreman Campbell proceeded to the north stairwell of the Polymerizer Building while Mr. Nordmeyer and the four (4) operators evacuated to a safe area in the Polymer Chemicals Warehouse.

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REPETITIVE ACCIDENT NO. 10-A
TOXIC CHEMICAL RELEASE (VINYL CHLORIDE) - (continued)

Page 2.

Foreman Campbell confirmed the head count with the Dryer Building Foreman, Dave Rodgers, and asked that Operator ' return to the north stairwell of the Polymerizer Building to assist him (Foreman Campbell) in securing the building.

Foreman Campbell proceeded to third floor and valved out all the knock-out tank drains and the inlet to the vinyl chloride monomer filters. He then proceeded to the mezzanine where he found an accumulation of vinyl chloride and water. The exhaust blowers on blend tanks 1, 2, 3 and 4 were shut off for fear of causing a spark. At this time, Foreman Campbell was joined by Operator

With Scott Air Paks, they both entered the mezzanine and proceeded to wash down the frozen vinyl chloride and water.

The "all-clear" was sounded at 1635 hours. Total elapsed time of the gas alarm was fifty-five (55) minutes.

FACTS SURROUNDING THE INCIDENT:

1. Vinyl chloride monomer was charged through No. 2 filter to a suspension polymerizer while the filter was on recovery to the blending resin recovery knock-out tank.
2. The blending resin recovery knock-out tank was being drained by the lo-sope/ blending resin operator who thought the drain line was connected to the lo-sope foam trap.
3. The No. 2 vinyl chloride filter was listed as "on recovery" on the shift status sheet but the polymerization charge operator had not noted this fact until after he had charged a polymerizer. Whereupon he communicated this problem to Foreman Campbell at the time of the gas alarm.
4. The inlet, outlet and recovery valves on No. 2 filter were not tagged to alert anyone that the filter was on recovery.
5. The polymerization charge operator switched to No. 2 from No. 3 filter at shift change (3-11's) when he noted that the preceding shift had charged polymerizer No. 3 last. Polymerizers No. 3 and 4 are being used to consume lo-sope recycle vinyl chloride in a controlled manner and whenever they are charged, No. 3 filter is used.
6. No. 1 filter was open to the atmosphere.
7. The blending resin recovery knock-out tank had drained to the blending resin slurry blend tank, but due to quality reasons the line was removed and allowed to drain to the floor after confirming that the water drained from the knock-out tank met EPA requirements.

NGC 01429

REPETITIVE ACCIDENT NO. 10-A
TOXIC CHEMICAL RELEASE (VINYL CHLORIDE) - (continued)

Page 3.

MANAGEMENT SYSTEMS INVESTIGATION:

1. Neither the pearl charging procedure nor the pearl recovery procedure made any reference to tagging the inlet, outlet or recovery valves when the filters are on recovery.
2. The blending resin procedure did not cover the proper procedure for draining the blending resin recovery knock-out tank.
3. The training for the lo-sope/blending resin operators did not comprehensively cover the draining of the knock-out tanks adequately. A formal training program for the polymerization area has not yet been extended to the blending resin process. However, all the "new" operators had received on-the-job training with an experienced operator and were considered qualified to operate using previous training requirements.

CORRECTIVE ACTION:

1. Disciplinary counseling will be conducted with the personnel involved, using Interaction Management Guidelines. J. V. Nordmeyer
2. Repipe the blending resin recovery knock-out tank and the 400 series knock-out tank to the lo-sope scrubber. This action would have contained the filter misoperation and no gas release would have occurred. A. W. Bade
3. Revise the pearl charging procedure to incorporate the tagging of the inlet, outlet and recovery valves when the filter is on recovery. R. C. Linneman
4. Incorporate the proper knock-out draining procedure into the blending resin procedure. S. L. McDonald
5. Review the gas alarm and its seriousness at the next safety meeting.

J. V. Nordmeyer

JVN:sfm

cc: See Distribution

Attachment (1)

NGC 01430

THE B. F. GOODRICH COMPANY
 SKETCHES AND COMPUTATIONS

JOB NO. _____

DATE _____

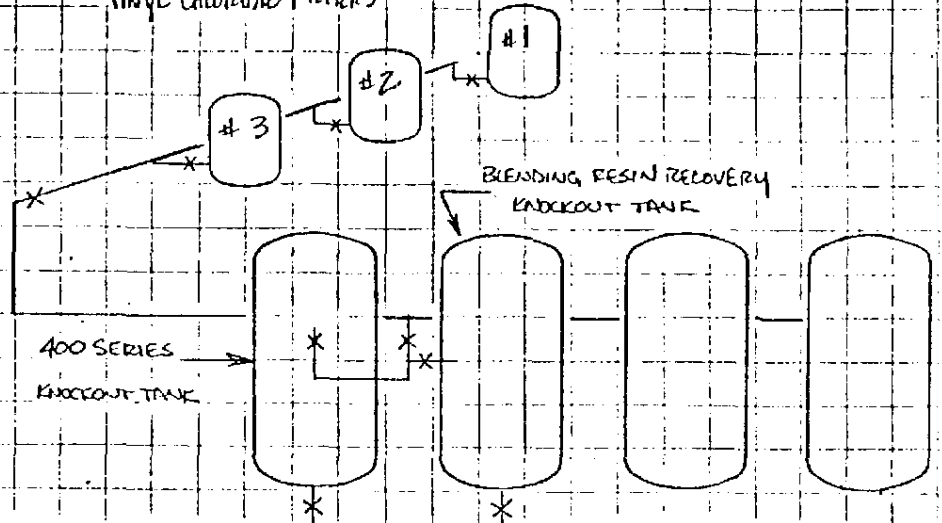
TITLE _____

Turn in with job - make orderly and with notes so anyone can follow.



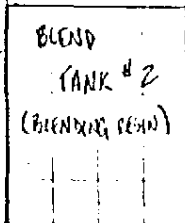
THIRD FLOOR

VINYL CHLORIDE FILTERS

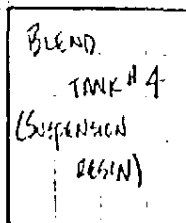


MEZANINE

to BLEND TANK #1



10 FLOOR



FIRST FLOOR

BFGOODRIE

INTER ORGANIZATION CORRESPONDENCE

TO	R. V. TEBBUTT	FIELD POINT OR DEPT. & BLDG. NO.	HENRY	DATE YOUR LETTER
FROM	D. E. GIFFIN	FIELD POINT OR DEPT. & BLDG. NO.	HENRY	DATE THIS LETTER
SUBJECT				8/25/82

REPETITIVE ACCIDENT NO. 10-A -- VINYL CHLORIDE GAS RELEASE
(REFRIGERATION VAPOR LOCK INCIDENT)

SUMMARY

On August 15, 1982 at approximately 0430, the Poly Building lost its refrigeration water flow. Nineteen polys were reacting and had to be short-stopped under emergency conditions to prevent pressure build-up and discharge to the atmosphere. During the emergency, one Suspension Charge Operator, C.T. Merdian (B shift), received minimal exposure to nitric oxide. No vinyl exposure was reported. All polys were controlled and no nitric oxide effect resulted. The loss of refrigeration water flow resulted when vinyl chloride gas leaked into the refrigeration system via condenser tube leaks from P27 and P34.

BOARD OF REVIEW

A Board of Review was held at 0700 hours on August 17, 1982 to review the incident. The following were present:

D.E.Giffin ----- Poly Building General Foreman
K.M.Campbell ----- "B" Shift Foreman
R.L.Rodgers ----- "C" Shift Foreman
R.D.Moore ----- Suspension Technical
R.K.LaCosse ----- Plant Engineer
D.L.Rys ----- Maintenance General Foreman
----- Refrigeration Operator
H.R.Calder ----- Safety
K.W.Prather ----- Technical Supervisor

NARRATIVE

Sunday morning, August 15, 1982, at approximately 0430, Kent Campbell, B Shift Foreman, found refrigerated water pressure at 0 PSIG after a number of polys began to show temperature and pressure rises. An effort to increase refrigeration H₂O (R/W) pressure by lowering the R/W bypass valve set point (see diagram) did not give any pressure increase. Refrigeration Operator, was contacted to determine the cause of the pressure loss. No abnormalities were observed by

Campbell began instructing his operators to short-stop all charges that were showing pressure rises. A total of twelve suspension polys (4, 5, 6, 7, 8, 11, 12, 15, 16, 18, 19, 20), one blending poly (P1) and six dispersion polys (26, 27, 29, 32, 34, 35) were reacting. Nitric oxide was initially used on the suspension and blending polys to allow make-up and addition time for the BPA shortstop. During the shortstopping of Poly 20, indicated the smelling of nitric oxide (approximately 0545). Campbell, upon learning this, took immediately to the Dispensary where oxygen was administered to him as a

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NGC 01432

precautionary measure. The Plant Nurse and Doctor were also contacted for consultation. Dave Rodgers, Dryer Building Foreman, assumed responsibility of monitoring so that Campbell could return to the Polymerization area. At approximately 0615, Dave Giffin, General Foreman, arrived to assist Campbell with the emergency. A gas was observed to be venting from the R/W* inert gas vent (see diagram). The gas was checked to be a hydrocarbon using the OVA and was assumed to be vinyl chloride. Based on this, a strategy for isolating the condenser systems was set up with the assistance of Rod Rodgers, C Shift Foreman. At 0710, all of the dispersion reflux condensers were isolated from the R/W* system except for Poly 26 and Poly 29. These condensers were needed until the polys were adequately controlled and shortstopped at 0750. These two condensers were then also valved out of the system. At 0850, the R/W* pressure and flows returned to normal and the vinyl chloride gas stopped venting from the R/W* inert gas vent.

For the next 12 hours, charging was terminated except to control recycle vinyl chloride levels in the recycle tanks. An elaborate vacuum pressure checking program was started to isolate the vinyl chloride source. All polys that had pressures greater than 40 PSIG during the morning emergency were included in the check program. The dispersion reflux condensers were highly suspected and, therefore, were first to be checked. After pressure checking the condensers two separate ways, a third method was developed and was started at 1800 Sunday evening. Simultaneously, the suspension poly vacuum check program was begun. R.D. Moore, Senior Suspension Technician, assisted K.M. Campbell who relieved Rod Rodgers at 1900.

Reflux condensers on P27 and P34 eventually showed refrigerated water leakage and were kept out of service until the condensers were repaired.

Monday morning, at the end of the 11/7 shift, was cleared of any ill effects from the nitric oxide exposure by the Plant Nurse, Robin Webber.

FACTS SURROUNDING THE INCIDENT

1. The dispersion reflux condensers had been mechanically drilled during July and August to remove resin build-up and to improve condenser efficiency. The condensers were pressure tested for external leaks. However, the normal poly vacuum check does not include the condensers due to reactor opening requirements.
2. The refrigeration system is operated by the Utility Department and is controlled to maintain a certain minimum flow to the chillers. Poly Building pressure is not monitored by the Refrigeration Operator. Further, the system pressure monitored by the Refrigeration Operator is a combination of cooling water and refrigerated water pumping systems. Therefore, Poly Building problems can occur without alerting the Refrigeration Operator.
3. The initial emergency spanned shift change between B & C shifts and communication between shifts were adequate to maintain good control.

* R/W - refrigeration water

4. Nitric oxide shortstop system was necessary to prevent run away charges. Without the nitric oxide, a large number of discharges to the atmosphere would have occurred. No specific nitric oxide leakage was reported during its use.
5. All operators were wearing fresh air masks as a result of red lite floor excursions. was wearing a fresh air mask at the time of his minimal exposure. The exposure occurred as he was obtaining BPA solution from the raw materials room. To perform this activity, an operator must disconnect from an air station and walk to another station. The exposure occurred during this activity.
6. C has been a Suspension Charge Operator for 2 years. He received formal training in October of 1980 and has continually worked in this job. Although emergency shortstopping is not routine, it is frequent enough that the operators know what activities are required including personnel safety protection. This was evident as observed by both "B" Shift Foreman and the General Foreman.
7. Vinyl chloride discharge occurred in a remote area that involved no vinyl chloride exposure to personnel (see diagram).

CONCLUSIONS

The incident occurred when vinyl chloride leaked from P27 and P34 reflux condensers into the refrigerated water header system. The vinyl chloride pressure was sufficient to push the refrigerated water back into the cooling water make-up supply line which is always open to maintain a hydraulic full refrigerated water system. Once the water level became low enough to affect the R/W* pumping efficiency, the flow to the Poly Building was severely reduced. Simultaneously, the gas vapor began to bleed from the inert gas vent valve.

The nitric oxide exposure occurred from fugitive emissions emanating from the couplings of the nitric oxide system. No major leaks were reported. Additional checking of the system will be recommended to insure system integrity. The medical treatment conducted insured quick recovery.

MANAGEMENT SYSTEMS INVESTIGATION

1. Operating procedure review showed that all bases were covered concerning leaky equipment except for the condensers on the Dispersion Polys. This was not an obvious problem until this incident occurred. All equipment in vinyl chloride service should be subject to a periodic vacuum or pressure check. The condensers had an external leak check requirement which would not and did not define an internal leak.

Additionally, a procedure for cleaning the condenser tubes had not been established. The tube failure appeared to have developed immediately after their cleaning. A smaller than normal drill bit may have been

* R/W - refrigeration water

used. Such a bit could bind and generate an angle sharp enough to bite into the tube.

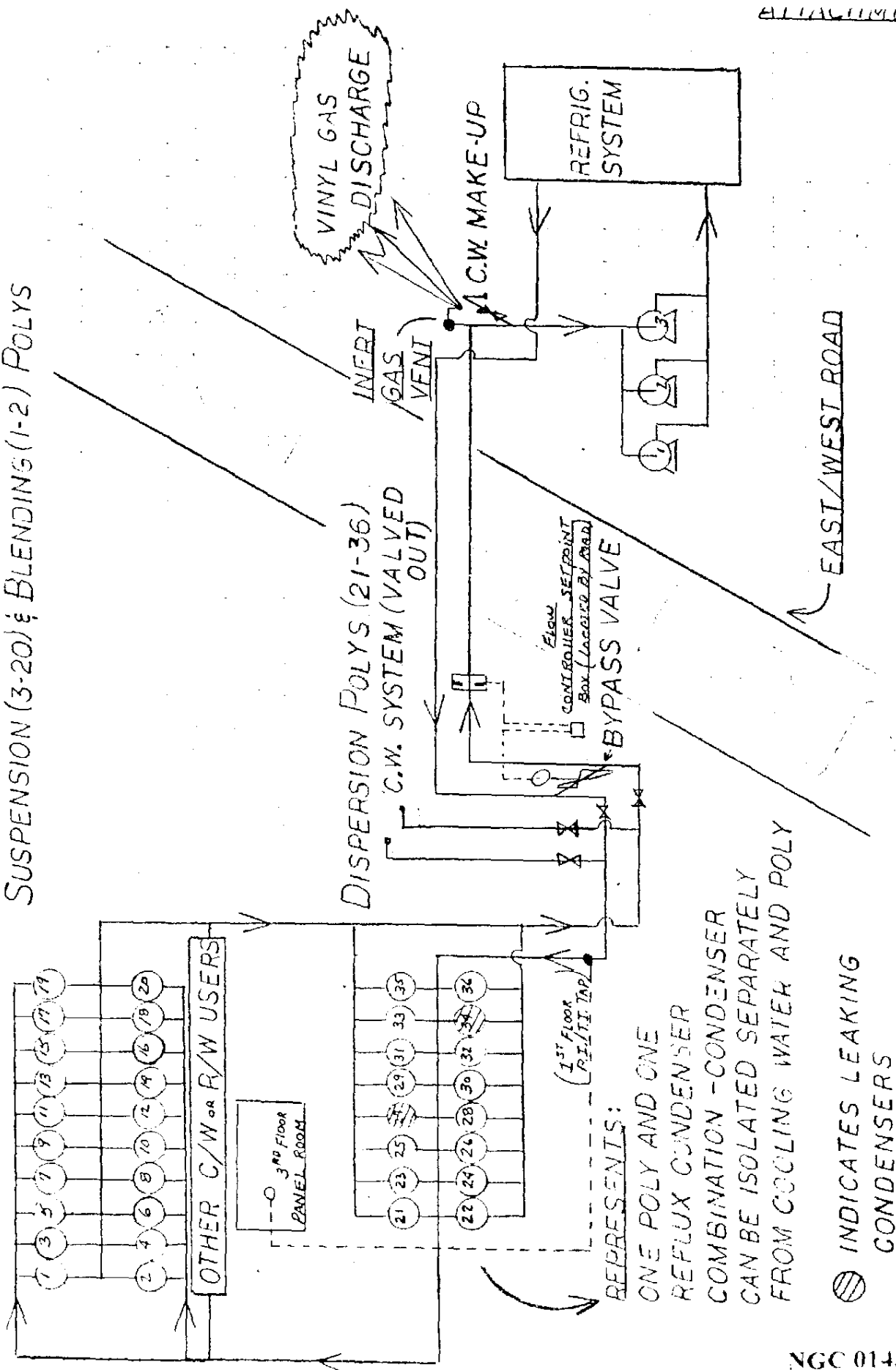
2. Management was directly involved in coordinating all of the emergency activities for shortstopping the polys, providing first aid to the personnel and controlling the emergency. Additional management personnel were also available to assist the Foreman and were utilized.
3. There were no ergonomic issues raised during the investigation.

CORRECTIVE ACTIONS

1. Check the integrity of the nitric oxide addition system for subtle leaks and other problems. Completed 8/17/82. (R.D.Moore)
2. Implement a vacuum check system on the dispersion reflux condensers. Completed 8/20/82. (S.L.McDonald)
3. Review Refrigeration Operator responsibilities and Recovery Operator responsibilities. Assess impact of manufacturing assuming responsibility of that area. Partially complete 8/17/82. (See Attachment 2). (D.E.Giffin)
4. Check inert gas vent valve for proper operation. (W.W.Walk)
5. Change pressure monitoring point in Refrigeration Area to reflect the true pressure of the refrigeration system and not the combined system. The present location monitors the cooling water and refrigeration systems together. (W.W.Walk)
6. Review the need for an air station east of Poly 20. Completed 8/18/82. (D.E.Giffin)
7. Investigate nitric oxide systems and determine if a better system is available. (D.E.Giffin)
8. Check all 16 polymerizer reflux condensers for refrigerated water leakage. Completed 8/20/82. (D.E.Giffin)
9. Investigate method for measuring inert gas vent valve venting frequency. (W.W.Walk)
10. Issue a procedure for properly drilling dispersion reflux condenser tubes. (S.L.McDonald)
11. Review incident in September safety meetings. (D.E.Giffin)

REFRIGERATION VAPOR LOCK INCIDENT (8/15/82)

SUSPENSION (3-20) & BLENDING (1-2) POLYS



REPRESENTS:
ONE POLY AND ONE
REFLUX CONDENSER
COMBINATION - CONDENSER
CAN BE ISOLATED SEPARATELY
FROM COOLING WATER AND POLY

⊗ INDICATES LEAKING
CONDENSERS

REFRIGERATION/RECOVERY OPERATOR'S
ACTIVITIES LIST DURING EMERGENCY

Refrigeration Operator:

1. Hooked up make up water line.
2. Checked inert vent valve venting frequency.
3. Monitored units continually.
4. When one unit was lost, secured unit by -
 - . Closing gas valve
 - . Closing economizer valve
 - . Shut off thermal purge
 - . Checked re-sets for permissible start
5. Adjusted flow controller at high rack.
6. Continue to monitor unit that was running.
7. Adjusted low oil pressure on compressor.

Recovery Operator:

1. Start-up McCormack and switched over.
2. Monitored high pressure on recovery system.
3. Switched columns to flush.
4. Coordinated with upstairs the dropping of heels, etc. to blow down tanks.
5. Investigate and started-up seal water pump that kicked out.
6. Monitored and trouble shot VCA non-compliance. Maintained N₂ purge.
7. Potential of starting up VGI due to high pressure on system.

Distribution:

W. C. Holbrook/T. S. Bialke/J. W. Lewis
C. J. Nosal/H. R. Calsing
~~H. Waltemate~~
A. D. Timpano - Brecksville
G. F. Krcmar/K. H. Lee, Jr.
W. C. Niederst/T. A. Waltermire
N. R. Aquino/D. H. Hall
R. C. Kaminski/E. C. Martinelli
F. E. Krause
F. W. Hovey/E. L. Beeler - Waterloo
W. D. Morse - Calvert City
J. A. Weaver/M. Merk
D. H. Marshall/C. N. Bush
Safety Engineers/Plant Managers
J. A. Kingma/M. G. Fletcher
R. A. Accarino/W. E. Horton
R. M. Kreager/R. Kissling
R. D. Hardesty/S. C. Alten
M. S. Fox/S. R. Guidry
J. L. Miller/W. C. Fultz
H. Mason/D. Dargan
K. J. Willings/R. J. Grahek
R. W. Taylor/L. V. Goode
W. L. Smith/P. W. Shore
R. L. Martin/G. E. Higby
J. Nagy/J. J. Dunn
G. A. Kaswell/R. V. Tebbutt
T. J. Guillot/C. Bayard
R. DeWolf/J. B. Canella
G. Morley/D. D. Quester
R. D. Goodman/A. L. Auvil
T. Fletcher/C. C. Lee
P. Selvage/H. Kletke

Local

M. E. Guyer
J. A. Bernardi
D. L. Humphrey
D. E. Giffin
D. L. Rys
F. V. Zemanek
W. J. Grudzinski
S. E. Wiedman
R. C. Linneman
V. D. Marquis
M. A. Ackerman
D. L. Piccinelli
J. S. Mooberry
J. P. Griffin

- Akron Chemical
- Avon Lake General
- Avon Lake Technical
- Avon Lake Technical
- Calvert City
- Deer Park
- Hattiesburg
- Henry
- LaPorte
- Long Beach
- Louisville
- Niagara Falls
- Pedricktown
- Plaquemine
- Shawinigan
- Altona, via Cleveland Safety
- Beltsville
- Scotford
- Terre Haute

RJG20: sfm

NGC 01438

F.1/c

Electrical Power Failure
December 15, 1987
Henry, Illinois Plant

Summary:

On Tuesday, December 15, 1987 at 6:57 AM, all primary and secondary electrical power was lost to the Central Illinois Light Company (CILCO) Marshall substation. This substation supplies electrical power requirements to the Henry Plant. When power was lost to the plant, emergency power systems began to activate:

- A) The diesel fire water pump generator started without incident.
- B) The boiler house diesel generator started after the programed 90 second delay. However, during the 90 second delay, instrument air supplies were lost. After the generator started, insufficient steam was available to drive the gas boiler forced draft fan turbine. Temporary wiring was then strung from the generator to No. 1 boiler fan, allowing it to resume steam generation at 2:30 PM.
- C) The PVC poly building emergency generator would not start. It was later determined a cable from the generator starter battery-pak was loose, delivering insufficient power to start the generator.

As a result of this power outage, PVC suspension resin reactions could not be controlled. Nitric oxide shortstop added to the reactors was ineffective without agitation. As a result, the rupture disc/relief valves on three polys, one blowdown tank, and two stripping columns failed. In addition, the pressure in seven reactors was controlled through manual venting. All totaled, 25,440 lbs. of vinyl chloride was released to the atmosphere. The building was secured by 8:15 AM.

Following investigation and repairs by CILCO personnel, power was restored to the plant via one of the two power loops at 4:20 PM. The back-up power source loop was restored at 5:00 AM on December 16th.

Over the extent of the emergency situation, coupled with the winter blizzard conditions, non-routine activities were required from everyone in the Plant. Throughout the entire power outage, safety was kept in proper perspective with no injuries being experienced.