The BFGoodrich Company
Chemical Group
R R 1, Box 15
Henry, Illinois 61537
309-364-2311

Certified Mail No. P 614 300 250

January 17, 1986

Illinois Environmental Protection Agency
Division of Air Pollution Control
5415 North University Avenue
Peoria, Illinois 61614

Attention: Mr. Richard Jennings, Regional Manager

Subject: Emergency Relief Valve Discharge - Paragraph 61.65 (a) of the National Emission Standard for Vinyl Chloride

Dear Mr. Jennings:

Pursuant to 40 CFR 61.65 (a) of the National Emission Standard for Vinyl Chloride, the BFGoodrich Company, at it's facility in Henry, Illinois is reporting an emergency relief valve discharge. The discharge is detailed in the following letter.

At approximately 1700 hours on January 10, 1986 the Waste Water Stripper safety relief valve discharged approximately 220 pounds of vinyl chloride to the atmosphere (See Calculation Attachment).

BFGoodrich has taken the following steps prior to the discharge to prevent such occurrences:

1. Rupture discs which are in place to protect safety relief valves, are replaced after a specific length of service to ensure their integrity.

2. Relief valves are removed and pressure checked as part of a preventative maintenance program.

3. The operators and area supervisors responsible for the operation of the equipment have been trained with respect to procedural steps for controlling releases and emergency conditions.

The following is the chronology of events leading to the discharge:

On January 10, 1986, the actuators to the shut off valves on the main cooling water line to the Polymerization Building were being retrofitted with new actuating mechanisms. The contractor performing the task positioned the valves in the half-open position required to install the new actuators. This did not affect operations.

Upon completion of the installation the building personnel began to open the valves to the full open position. While opening the valves the personnel were informed that the cooling water supply pressure was inadequate for the Polymerization Building. Realizing that the valves must have been closed, the personnel reversed the operation of the valves

NGC 01609

The loss of cooling water to the Polymerization building resulted in loss of control of the batches in reaction and resulted in an increase in the recovery system pressure. All Polymerizers were controlled following the standard emergency procedures. However, the increased pressure in the recovery system resulted in the overpressure of the waste water stripper causing the discharge. The area personnel responded to this condition and stopped all feeds and steam to the waste water stripper. This immediately stopped the overpressure condition.

The Cause of the Discharge

Upon review of the incident it was discovered that the existing shut off valves were not standard ANSI valves, in that their closure direction was reversed. Standard ANSI operators had been installed on the valves. The building personnel following the clearly labeled opening direction on the actuator inadvertently closed the valve causing the loss of cooling water.

Corrective Action to Prevent the Recurrence

1. This incident has been reviewed with all engineering, operational, and contractor personnel involved.

2. This incident will be reviewed with all other personnel in the Polymerization area and all emergency steps involving cooling water failure will be reviewed.

3. The cooling water valve acuators will be modified to indicate the proper closure direction.

If you have any questions concerning this report, please feel free to call me at (309) 364-2311.

Sincerely,

Kenneth J. Willings

Kenneth J. Willings
Sr. Environmental/Safety Engineer

rdm

cc: Chris Romaine/IEPA

## METHOD FOR DETERMINING THE AMOUNT OF VINYL CHLORIDE

Facts: 1. Approximate duration of the release ~ 2 minutes
2. The discharge was approximately 42% vinyl chloride

Calculation:

$$A = \frac{V\sqrt{G}\sqrt{T}\sqrt{Z}}{1.175\ CK_d\ P\ K_b}$$

(See attached Farris Safety Relief Valv calculation for vapors and gases.)

$$V = \frac{A\ (1.175)\ CK_d\ P\ K_b}{\sqrt{G}\sqrt{T}\sqrt{Z}}$$

V = Volume (SCFM) = ?
A = Orifice = 1.287 sq. in.
G = Specific Gravity = 1.304 of the Vapor in the column
T = Temperature = 700°R
Z = Compressibility = 1.0 Factor
C = Gas Constant = 356
Kd = Coefficient of = 0.953 Discharge
P = Relieving = 88.7 psia Pressure
Kb = Vapor Flow = 1 Correction Factor

$$V = \frac{(1.287)(1.175)(356)(.953)(88.7)(1)}{(\sqrt{1.304})(\sqrt{700^{\circ}R})(\sqrt{1.0})}$$

= 1506 SCFM

Q = Quantity of VCL released

$$Q = 1506\ SCFM \times 2\ Minutes \times \frac{\#\ Moles}{359\ SCF} \times \frac{62.5\#}{\#\ Mole} \times (0.42)$$

Q = 220 lbs

NGC 01611

## [illegible] FORMULAS

Before initiating any calculations, it is necessary to establish the general category of the pressure relief valve being considered. This section covers conventional spring loaded types and BalanSeal spring loaded types separately. Pilot operated types are covered in a separate catalog.

Given the rate of fluid flow to be relieved, the usual procedure is to calculate first the minimum area required in the valve orifice for the conditions contained in one of the following formulas. In the case of steam, air or water, the selection of an orifice may be made directly from the capacity tables in Section 4 if so desired.

In either case, the second step is to select the specific type of valve that meets the pressure and temperature requirements as described in section 5, Selection.

General formulas are given first, to identify the basic terms which correlate with ASME Pressure Vessel Code, Section VIII. Then, an alternate sizing method is given to provide modified formulas which reduce computation.

Since these formulas are conservative, it is recommended that computations of relieving loads avoid cascading of safety factors or multiple contingencies beyond the reasonable flow required to protect the pressure vessel.

## Conventional Valves — constant back pressure only

The conventional valve may be used when the variation in backpressure does not exceed 10% of the set pressure, provided the corresponding variation in set pressure is acceptable.

### Orifice area calculations

**VAPORS or GASES . . .**
**— Lbs./hr. —**

$$A = \frac{W\sqrt{T}\sqrt{Z}}{CK_dP\sqrt{M}\,K_b}$$

CONSTANT BACK PRESSURE

$K_b$ = 1 when back pressure is below 55% of abs. relieving pressure.

**VAPORS or GASES . . .**
**— S.C.F.M. —**

$$A = \frac{V\sqrt{G}\sqrt{T}\sqrt{Z}}{1.175\,CK_dP\,K_b}$$

CONSTANT BACK PRESSURE

$K_b$ = 1 when back pressure is below 55% of abs. relieving pressure.

**STEAM . . .**
**— Lbs./hr. —**

$$A = \frac{W_s}{51.5\,K_dP\,K_b\,K_{sh}}$$

CONSTANT BACK PRESSURE

$K_b$ = 1 when back pressure is below 55% of abs. relieving pressure.
$K_{sh}$ = 1 for Sat. Steam

**LIQUIDS . . .**
**— G.P.M. —**

$$A = \frac{V_L\sqrt{G}}{38.0\,K_d\sqrt{1.25\,P_1 - P_2}\,K_p\,K_u}$$

CONSTANT BACK PRESSURE $P_2$

$K_p$ = 1 at 25% overpressure
$K_u$ = 1 at normal viscosities

**AIR . . .**
**— S.C.F.M. —**

$$A = \frac{V_a\sqrt{T}}{418\,K_dPK_b}$$

CONSTANT BACK PRESSURE

$K_b$ = 1 when back pressure is below 55% of abs. relieving pressure.

### Nomenclature

- **A** — Required orifice area in square inches. This value may be compared with the effective discharge areas published in this catalog, ANSI Standard B146.1 and defined in ANSI Standard B95.1.
- **W** — Required vapor capacity in pounds per hour.
- **$W_s$** — Required steam capacity in pounds per hour.
- **V** — Required gas capacity in S.C.F.M.
- **$V_a$** — Required air capacity in S.C.F.M.
- **$V_L$** — Required liquid capacity in U. S. gallons per minute.
- **G** — Specific gravity of gas (air = 1) or specific gravity of liquid (water = 1) at actual discharge temperature. A specific gravity at any lower temperature will obtain a safe valve size.
- **M** — Average molecular weight of vapor.
- **P** — Relieving pressure in pounds per square inch absolute — set pressure + overpressure + 14.7.
- **$P_1$** — Set pressure at inlet, psig.
- **$P_2$** — Back pressure at outlet, psig.
- **T** — Inlet temperature °F. absolute (°F. plus 460).
- **Z** — Compressibility factor corresponding to T and P (if this factor is not available, compressibility correction can be safely ignored by using a value of Z = 1.0).
- **C** — Gas or vapor flow constant. Select from table, page 3.04 using ratio of specific heat "k" of vapor or gas being considered.
- **k** — Ratio of specific heats, Cp/Cv. This value is constant for an ideal gas. If this ratio is not known, the value k = 1.001, C = 315 will result in a safe valve size. Isentropic coefficient n may be used instead of k.
- **$K_p$** — Liquid capacity correction factor for overpressures lower than 25% from curve on page 3.07.
- **$K_b$** — Vapor or gas flow correction factor for constant back pressures above critical pressure from curve on page 3.06.
- **$K_v$** — Vapor or gas flow factor for variable back pressures from curve on page 3.05. Applies to BalanSeal valves only.
- **$K_w$** — Liquid flow factor for variable back pressures from curve on page 3.06. Applies to BalanSeal valves only.
- **$K_{sh}$** — Super heat correction factor from table on page 3.07.
- **$K_u$** — Viscosity correction factor from curve on page 3.08.
- **$K_d$** — Coefficient of discharge (0.953 for air, steam, vapors, gases; 0.64 for liquids; for use in these formulas).

## JANUARY 10, 1986 WASTEWATER STRIPPING COLUMN

| CORRECTIVE ACTION | STATUS |
|---|---|
| 1. This incident has been reviewed with all engineering, operational, and contractor personnel involved. | Complete |
| 2. This incident will be reviewed with all other personnel in the Polymerization area and all emergency steps involving cooling water failure will be reviewed. | Complete |
| 3. The cooling water valve actuators will be modified to indicate the proper closure direction. | Complete |

B.F.Goodrich **INTER-ORGANIZATION CORRESPONDENCE**

| TO | FIELD POINT OR DEPT. & BLDG. NO. | DATE YOUR LETTER |
|---|---|---|
| R. J. Grahek | Henry | |
| **FROM** | **FIELD POINT OR DEPT. & BLDG. NO.** | **DATE THIS LETTER** |
| D. L. Rys | Henry | 6/16/87 |

SUBJECT

VINYL CHLORIDE RELEASE FROM BLOWDOWN TANK #1

REDACTED

SUMMARY OF INCIDENT

On Saturday, June 6, 1987 at 2000 hours, the 3" rupture disc on Blowdown Tank #1 burst and vented Blending resin slurry and VCL gas to the atmosphere. Blowdown was stopped immediately and valving was changed to the secondary rupture disc system. Venting time was limited to approximately 2 minutes, resulting in 201 pounds of VCM released to the atmosphere. There was no equipment damage or personnel exposure to VCM.

BOARD OF INQUIRY REPORT

The Board of Inquiry was conducted on June 7, 1987 at 0700 hours with the following personnel in attendance:

| | |
|---|---|
| | - B Shift Charge Operator |
| Kevin Bullington | - B Shift Temporary Foreman |
| | - D Shift Downstairs Recovery Operator |
| Larry Loebach | - D Shift Foreman |
| Ron Moore | - Sr. Process Engineer |
| | - D Shift Upstairs Recovery Operator |
| Dave Rys | - Geon Resin Manager |

NARRATIVE

Geon 213 Blending resin charge #3391 was initiated in Poly #1 at 1400 hours on June 6, 1987 as per standard charging procedure. No abnormalities occurred. The reaction temperature was adjusted once to achieve specification limits.

Five hours after reaching reaction temperature, the temperature and pressure began increasing. At this time, the cooling water flow to the reactor jacket and baffles was at maximum rate. The water rates on the quick fill and seal flush systems were adjusted to maximum. The temperature and pressure continued to increase.

At 149° F. reactor temperature and 165 psig reactor pressure the operator notified the Foreman of the problem. After evaluating the situation, the decision was made to drain the charge to Blowdown Tank #1 for recovery of the unreacted VCM, without adding shortstop. The operator notified downstairs recovery to assure that the Blowdown Tank was empty. Upon receiving confirmation, the charge was drained 5.75 hours after reaction temperature had been reached.

Shortly thereafter, the 3" rupture disc on the Blowdown Tank ruptured. After ascertaining the source of the venting, the drain valve was closed and then the valve on the 3" vent line was closed. Over pressure protection of the Blowdown Tank was maintained by a second set of 4" rupture discs. After conditions had stabilized the charge was completely drained to the Blowdown Tank and recovered without further incident. Both sets of rupture discs were removed for inspection. Further charging was suspended until the Board of Inquiry was held.

FACTS SURROUNDING THE INCIDENT

1. #2 chiller unit was shutdown on Friday, June 5, 1987 due to a freon leak in a newly installed stainless steel expansion joint. With only one chiller operational, LoSope charge rates were decreased while maintaining Suspension and Blending charge rates.

2. Cooling water temperature had increased to 75° F. Friday night but had decreased and stabilized at 60° F. by 0700 hours on Saturday morning. At 1530 hours Saturday, the temperature increased to 68° F. and continued to rise to 80° F. at 1800 hours. The one chiller was operating satisfactorily but could not handle the load.

3. When the temperature began to increase on Saturday, there were 11 polys calling for cooling. Three 110X500 charges were recovered early.

4. Standard operating procedure will call for the addition of BHT at the initiation of a charge to control the reaction if the cooling water temperature is above 70° F. In this case, the water temperature at that time was stable at 60° F. and no BHT was added.

5. Normal reaction conditions for Geon 213 are as follows:

| | |
|---|---|
| Reaction temperature | - 143± 1° F. |
| Reaction pressure | - 115-150 psig |
| Reaction time | - 6 hours |
| Blowdown pressure | - 30 psig |

6. The Blowdown Tank is equipped with 2 sets of rupture discs. There is a dual set of 3" discs rated at 143 psig at 143°F. with a manual valve located between the tank and the discs. There is also a dual set of 4" discs rated at 172 psig at 165°F. without a valve. This design was installed as part of the Blending resin expansion in 1983.

7. There is no scheduled replacement of the rupture discs on the Blowdown Tanks. The discs on Blowdown Tank #1 have not been changed since original installation in 1983. The removed rupture discs were inspected for any abnormalities. The 3" discs were ruptured due to over pressure. The 4" discs were intact and showed no abnormalities. There was a good deal of rust above the top 4" disc.

8. The recovery rate on Blowdown Tank #1 is controlled to minimize the amount of carryover to the compressor system during Blending resin manufacture.

9. The Blowdown Tanks do not have full range pressure recorders or high pressure alarms.

CONCLUSIONS

The reaction rate on Blending resin charge #3391 could not be controlled due to the high cooling water temperature. The reaction rate at the time of draining to the Blowdown Tank was greater than the ability to recover the unreacted VCM. The temperature and pressure continued to increase until the burst pressure of the 3" rupture disc was reached.

CORRECTIVE ACTION

1. The decision was made in the meeting to shortstop any abnormal Blending resin charge prior to transferring to the Blowdown Tank.

2. Update our procedures for handling all abnormal PVC resin charges. To be reviewed in the Foremen's Meeting scheduled for 6/12/87. (JPG - 6/30/87)

3. Investigate the criteria for BHT addition to Blending resin charges. (RDM - 6/30/87)

4. Determine a frequency for replacing rupture discs on the Blowdown Tanks. (JPG - 6/30/87)

5. The bottom 4" disc will be sent out and tested for burst pressure to determine if weakening had occurred. (AJS - 6/30/87)

6. Determine the design criteria for the rupture disc assemblies on Blowdown Tank #1. (DLP - 6/30/87)

7. Install full range pressure recorders and high pressure alarms on the Blowdown Tanks. (WHL - 8/30/87)

8. Review our philosophy on charging during abnormal conditions. Production priority must not come before safety, environmental concerns and quality. (DLR - 7/30/87)

9. Review this incident with all personnel in the Shift Meetings. (Foremen - 7/30/87)

Dave

D. L. Rys

DLR:bh
attachments
See Distribution Sheet

BLOWDOWN TANK # 1 VINYL RELEASE :

---

Volume of BDT = 4,990 Gal.

Slurry Level @ time of Rupture Disk Failure = 63 %

Temperature = 149 °F ( 609 °R )

Pressure on Reactor when charge dropped to BDT = 165 psig. ( P1 )

Pressure on BDT when valve below Rupture Disk closed = 80 psig. ( P2 )

---

4,990 Gal. x ( 1 - 0.63 ) = 1,846 Gal.

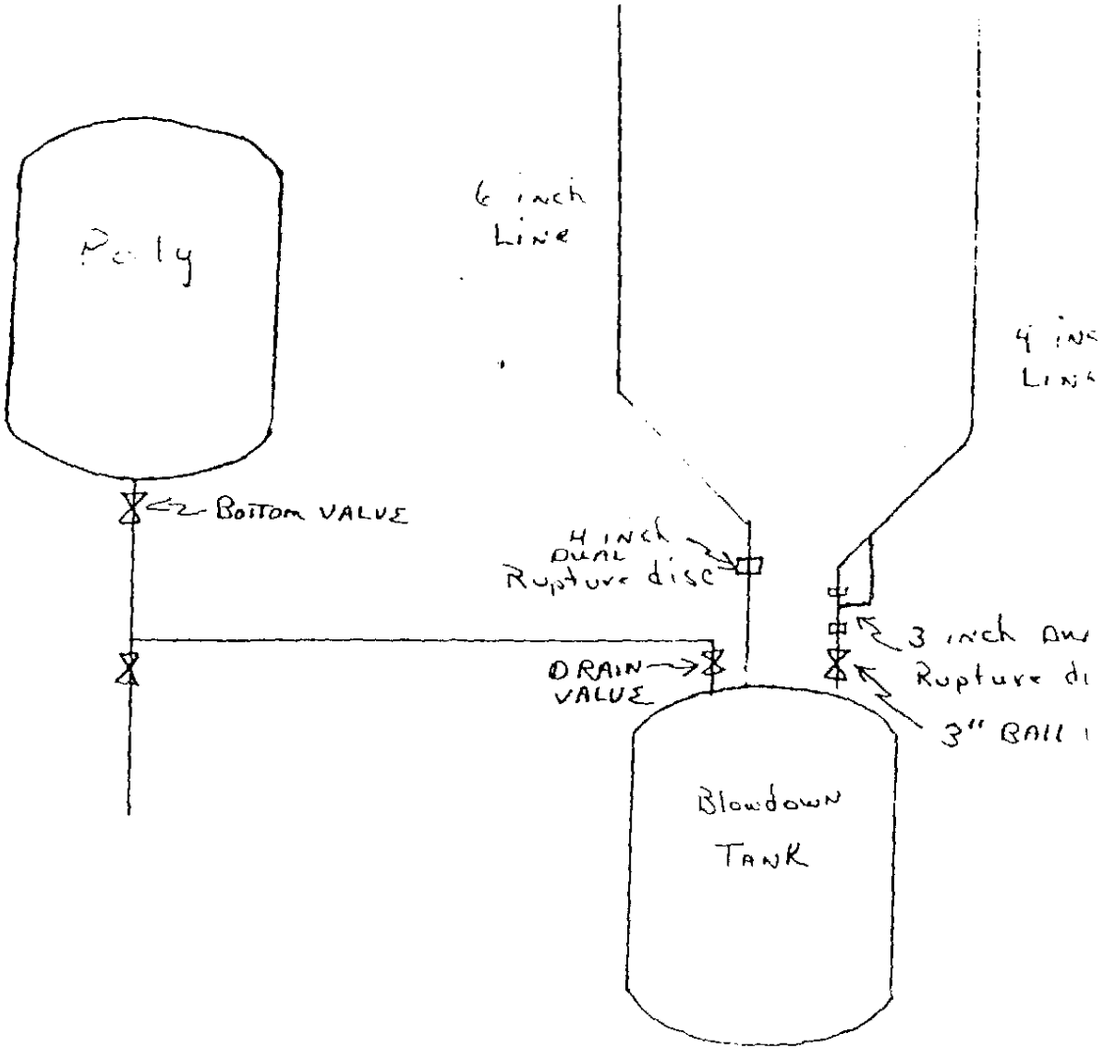
1,846 Gal. / 7.481 Gal./ cu.ft. = 246.8 cu.ft.

$$\frac{(P1 - P2) * V}{R * T} = N$$

R = Gas Constant = 10.73 $\frac{\text{cu.ft.*psi}}{\text{lb.mole*°R}}$

$$\frac{(165 - 80)\text{psi} \times 246.8\ \text{cu.ft.}}{(10.73) \times 609\ °R} = 3.21\ \text{lb.moles VCM}$$

3.21 lb.moles VCM * 62.5 lb.VCM / lb.moles VCM = 201 lbs. VCM


Poly
6 inch
Line
4 ins
Lins
Bottom VALVE
4 inch
DUAL
Rupture disc
3 inch dua
Rupture di
DRAIN
VALVE
3" BALL
Blowdown
Tank

K.J. Willings

**BFGoodrich**

CERTIFIED MAIL NO. P 299 839 533

Geon Vinyl Division
Specialty Polymers & Chemicals Division
R.R. 1, Box 15
Henry, Illinois 61537
309-364-2311

R.J. Grahek
Plant Manager

June 16, 1987

Illinois Environmental Protection Agency
Division of Air Pollution Control
5415 North University
Peoria, IL 61614

Attention: Mr. Richard Jennings, Regional Manager

SUBJECT: EMERGENCY RELIEF VALVE DISCHARGE REPORT

Dear Mr. Jennings:

In accordance with the requirements for 40 CFR 61.65 (a) of the National Emission Standard for vinyl chloride. The BFGoodrich Company is reporting an emergency relief valve discharge at its Henry, Illinois facility.

Should you have any questions concerning this report, please contact Mr. Kenneth J. Willings, Manager Safety, Health, and the Environment, at (309) 364-2311, extension 214.

Sincerely,

THE BFGOODRICH COMPANY
Geon Vinyl Division

R J Grahek

Robert J. Grahek
Plant Manager

rdm

cc: Chris Romaine

NGC 01620

THE BFGOODRICH COMPANY
HENRY, ILLINOIS

VINYL CHLORIDE RELEASE REPORT
(40 CFR 61.65 (a) )

| | |
|---|---|
| Type of Release: | Rupture Disc |
| Day/Time of Release: | Saturday, June 6, 1987; 2000-2002 hours |
| Quantity of Vinyl Chloride Released: | 201 lbs. (See attached calculations). |
| ource/Nature: | Emergency relief of pressure in No. 1 blowdown tank. |

Actions Taken Prior to Discharge to Prevent Recurrence:

1. New operators are given several weeks of on-the-job training wit experienced operators.

2. Written standard operating procedures are provided to the operators.

3. Foreman supervision is provided.

4. Training sessions are held on the vinyl chloride standard (40 CFR Par 61, Subpart F) and Company standard operating procedures annually t ensure compliance.

5. There is a scheduled maintenance and replacement program for rupture discs.

Emergency Discharge - Chronology of Events:

1. On Friday, June 5, 1987, the No. 2 Chiller unit serving the polymerization building was taken out of service for maintenance.

2. The cooling water temperature stabilized on Saturday, June 6, 1987 and was within the temperature range specified in the standard operating procedures.

3. A blending resin charge was initiated in polymerizer No. 1 at 1400 hours on Saturday, June 6, 1987.

4. At 1900 hours, the polymerizer temperature and pressure began to increase. Cooling water flow was increased to the maximum.

5. The pressure continued to increase and the charge in the polymerizer No. 1 was equalized to the No. 1 blowdown tank at 1945 hours on Saturday, June 6, 1987. The No. 1 blowdown tank had been valved to the vinyl chloride recovery system prior to equalizing polymerizer No. 1 to the blowdown tank. This is standard operating procedure for controlling over pressure reaction of blending resins and has always been successful prior to this event.

. At 2000 hours on Saturday, June 6, 1987, the primary 3" dual rupture discs on blowdown tank No. 1 burst.

. Polymerizer No. 1 drain valve was closed to No. 1 blowdown tank.

. The valve under the 3" dual rupture disc assembly was closed to stop the venting, and the secondary 4" dual rupture disc assembly maintained the vessel pressure.

Polymerizer No. 1 was completely drained to No. 1 blowdown tank once conditions stabilized and was recovered without further incident.

Cause of Discharge:

1. The reaction rate of the blending resin in polymerizer No. 1 could not be controlled with maximum cooling water flow thus requiring draining of the polymerizer to No. 1 blowdown tank for recovery.

2. The rate of unreacted vinyl chloride being transferred into the blowdown tank exceeded the recovery capacity of the vinyl chloride recovery system. Thus the pressure continued to increase until the 147 psig burst pressure of the primary 3" dual rupture discs was reached.

Corrective Action to Prevent Recurrence:

1. The incident will be reviewed with all operating personnel in the polymerization area.

2. Standard operating procedures will be modified to require the addition of the reaction shortstop to any abnormal blending resin charge prior to draining to the blowdown tank for recovery.

3. The preventative maintenance program for rupture disc replacement will be reviewed and modified as necessary.

BLOWDOWN TANK # 1 VINYL RELEASE :

Volume of BDT = 4,990 Gal.

Slurry Level @ time of Rupture Disk Failure = 63 %

Temperature = 149 °F ( 609 °R )

Pressure on Reactor when charge dropped to BDT = 165 psig. ( P1 )

Pressure on BDT when valve below Rupture Disk closed = 80 psig. ( P2 )

---

4,990 Gal. x ( 1 - 0.63 ) = 1,846 Gal.

1,846 Gal. / 7.481 Gal./ cu.ft. = 246.8 cu.ft.

$$\frac{(P1 - P2) * V}{R * T} = N$$

R = Gas Constant = 10.73 $\frac{\text{cu.ft.*psi}}{\text{lb.mole*°R}}$

$$\frac{(165 - 80)\text{psi} \times 246.8\ \text{cu.ft.}}{(10.73) \times 609\ °R} = 3.21\ \text{lb.moles VCM}$$

3.21 lb.moles VCM * 62.5 lb.VCM / lb.moles VCM = 201 lbs. VCM

JUNE 6, 1987 BLOWDOWN TANK NO. 1

| CORRECTIVE ACTION | STATUS |
|---|---|
| 1. The incident will be reviewed with all operating personnel in the Polymerization area. | Complete |
| 2. Standard Operating Procedure will be modified to require the addition of the reaction shortstop to any abnormal blending resin change prior to draining to the blowdown tank for recovery. | Complete |
| 3. Preventative maintenance program for rupture disc replacement will be reviewed and modified as necessary. | Complete |

**BFGoodrich** CERTIFIED MAIL NO. P 299 839 675

The BFGoodrich Company
Chemical Group
R.R. 1, Box 15
Henry, Illinois 61537
309-364-2311

November 25, 1987

Illinois Environmental Protection Agency
Division of Air Pollution Control
5415 North University Avenue
Peoria, IL 61614

Attention: Mr. Richard Jennings, Regional Manager

Subject: Emergency Relief Valve Discharge - Paragraph 61.65 (a) of the National Emission Standard for Vinyl Chloride

Dear Mr. Jennings:

Pursuant to 40 CFR 61.65 (a) of the National Emission Standard for Vinyl Chloride, the BFGoodrich Company, at it's facility in Henry, Illinois is reporting an emergency relief valve discharge. The discharge is detailed in the following letter.

At approximately 10:40 hours on November 20, 1987 the Waste Water Stripper, the Waste Water Hold Tank, and APRS "Burp" Tank safety relief devices discharged vinyl chloride to the atmosphere.

The quantities released were:

Waste Water Stripper - 938 lbs (1)
Waste Water Hold Tank - 1732 lbs (1)
APRS "Burp" Tank - 559 lbs (1)

(1) See Calculation Statement

The following is a chronology of events leading to the discharge:

On November 20, 1987 at approximately 10:00 hours the low pressure alarm for cooling water sounded. The operating personnel responded to the cooling water supply area and tried to determine the reason for the low pressure alarm. The loss of cooling water to the polymerization building resulted in an increase of the pressure on the recovery system and a loss of control of the batches in reactors. All polymerizers were controlled following the emergency procedures in place. The increased recovery pressure resulted in the over pressure of the waste water stripper, the waste water hold tank, and the APRS "Burp" Tank.

The area personnel responded to this condition and stopped all feeds and steam to the waste water stripper. They also switched the waste water hold tank safety relief device to the standby safety relief device. These actions immediately stopped the release and over pressure conditions.

Cause of Discharge:

Upon review of the incident it was discovered that the loss of cooling water to the Polymerization Building was caused by the chilled water system failing and the area personnel were unable to switch to the cooling tower system due to the valve actuation not functioning properly. The failure of the cooling water system resulted in the high pressure on the recovery system.

BFGoodrich has taken the following steps prior to discharge to prevent occurrences:

1. Rupture discs which are in place to protect safety relief valves, are replaced after a specific length of service to protect their integrity.

2. Relief valves are removed and pressure checked as part of a preventative maintenance program.

3. The operator and area supervisors responsible for the operation of the equipment have been trained with respect to procedural steps for controlling releases and emergency conditions.

4. The actuators on the cooling water valves were modified to indicate open/closed position.

Corrective Action to Prevent the Recurrence:

1. This incident will be reviewed with all operational personnel in the polymerization area and all emergency steps involving cooling water failure will be reviewed.

2. The steam supply to the waste water stripper system will be reviewed and modified to provide an automatic shutoff when a high pressure condition is determined in the stripper.

3. A review of the feed system to the waste water stripper holding tank and stripper is to be done, and modifications recommended from this review to prevent over pressuring the system will be implemented.

4. The cooling water supply system will be reviewed and modifications will be made to ensure that the back-up cooling water supply can be actuated.

Sincerely,

Kenneth J. Willings

Kenneth J. Willings
Sr. Safety/Environmental Engineer
BFGoodrich Company
Henry, Illinois

rdm/S280

VCL DISCHARGE FROM WASTE WATER STRIPPER SAFETY RELIEF VALVE
METHOD FOR DETERMINING THE AMOUNT OF VINYL CHLORIDE

FACTS: 1. Approximate duration of the release - 5 minutes
2. The discharge was approximately 84.3% vinyl chloride

Calculation:

$$A = \frac{V \sqrt{G} \sqrt{T} \sqrt{Z}}{1.175 \quad CKd \quad P \quad Kb}$$

(See attached Farris Safety Relief Valves calculation for vapors and gases.)

$$V = \frac{A\ (1.175)\ CKd\ P\ Kb}{\sqrt{G}\ \sqrt{T}\ \sqrt{Z}}$$

V = Volume (SCFM) = ?
A = Orifice = 1.287 sq. in.
G = Specific Gravity = 1.92 of the Vapor in the column
T = Temperature = 670°R
Z = Compressibility Factor = 1.0
C = Gas Constant = 356
Kd = Coefficient of Discharge = 0.953
P = Relieving Pressure 89.7 psia
Kb = Vapor Flow Correction Factor = 1

$$V = \frac{(1.287)(1.175)(356)(.953)(89.7)(1)}{(\sqrt{1.92}) \quad (\sqrt{670°R}) \quad (\sqrt{1.0})}$$

= 1278 SCFM

Q = Quantity of VCL released

$$Q = 1278\ SCFM \times 5\ minutes \times \frac{\#\ Moles}{359\ SCF} \times \frac{62.5\#}{\#\ MOLE} \times (0.843)$$

Q = 938 lbs

VCL DISCHARGE FROM WWS HOLD TANK SAFETY RELIEF VALVE

Basis

1. Two inch schedule 40 pipe - 2.06 in ID
2. 100 psig tank pressure during discharge
3. Four minute discharge time
4. Sonic velocity at discharge due to high $\Delta P/P'$ and short section of pipe.
5. Tank temperature = 150°F
6. Ideal gas law assumed

$Vs = 68.1 \sqrt{kp'\bar{V}}$ where Vs = sonic velocity ft/sec
k = ratio of heat capacity Cp/Cv (1.3)
P' = Pressure is psia
$\bar{V}$ = Specific Volume

$W = \frac{Vd^2}{0.0509\ \bar{V}}$ where W = flow in lb/hr
V = velocity ft/sec
$d^2$ = pipe internal diameter $in^2$

for VCL at 150°F $\bar{V} = \frac{(359\ ft^3)(610°R)}{(62.5\ lb/mole)(492°R)} = 7.12\ ft^3/lb$

$Vs = 68.1 \sqrt{(1.3)(114.7)(7.12)} = 2219$ ft/sec

$W = \frac{(2219)(2.06^2)}{(.0509)(7.122)} = 25,976$ lb/hr

(4/60 hr)(25,976 lb/M) = 1732 lb VCL

# METHOD FOR DETERMINING THE AMOUNT OF VINYL CHLORIDE BURP TANK RELIEF VALVE RELEASE

Assumption - 30 second release
- Vapor in 100% VCL
- Vapor temperature = 150°F = 610°R

Calculation of vent stream flow:

Z = Compressibility Factor = 1.0
V = Volume scfm = ?
A = Orifice = 4.34 sq. inch
G = Specific Gravity = 2.16
C = Gas Constant = 356
Kd = Coefficient of discharge = 0.953
P = Relieving Pressure = 134.7 psia
Kb = Vapor flow correction factor = 1

$$V = \frac{(A)(1.175)(C)(Kd)(P)(Kb)}{\sqrt{G}\ \sqrt{T(°R)}\ \sqrt{Z}}$$

Specific Gravity G = 62.5/29 = 2.16

$$V = \frac{(4.34)(1.175)(356)(.953)(134.7)(1)}{\sqrt{2.16}\ \sqrt{610}\ \sqrt{1}} = 6418 \text{ scfm}$$

$$Q = \frac{(6418)(62.5)}{(2)\ (359)} = 559 \text{ lb VCL}$$