

## VENT RELIEF SYSTEMS

1. RESULTS OF SURVEY
2. METHODS OF RELIEF SYSTEM SIZING
3. QUESTIONS & DISCUSSION

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## SUMMARY OF SURVEY

### I. OVERPRESSURE PROTECTION

#### PRIMARY RELIEF SYSTEMS -

- MOST PVC REACTORS ARE FITTED WITH RUPTURE DISK - RELIEF VALVE COMBINATIONS
- ALL PRIMARY RELIEF SYSTEMS DISCHARGE TO THE ATMOSPHERE
- MANY REACTORS HAVE MULTIPLE RELIEVING SYSTEMS
- ALMOST 100% OF THE POLYMERIZERS HAVE MANUAL VENTS
- SOME MANUAL VENTS DISCHARGE TO THE ATMOSPHERE - GAS HOLDERS - RECOVERY
- ONLY A FEW COMPANIES HAD BLOCK VALVES PRECEEDING THE RUPTURE DISK OR RELIEF VALVE

### II. SIZING OF RELIEF SYSTEMS

- TOTAL RELIEF AREA AVAILABILITY (CALCULATED ON NOZZLE SIZE) VARIED FROM A MIN. OF 1.57 TO A MAXIMUM OF 12.56 SQUARE INCHES PER 1,000 GAL. OF REACTOR CAPACITY
- SMALL REACTORS 1,000 - 5,000 GALS. = 2 - 6 SQ. IN.  
1,000 GAL.
- LARGE REACTORS 6,000 - 35,000 GALS. 3 - 12.56 SQ. IN.  
1,000 GAL.

### III. OVERPRESSURE PREVENTION

- MANY REACTORS HAVE A RELIEF SYSTEM THAT CAN BE ACTIVATED EITHER AUTOMATICALLY OR MANUALLY
- A FEW OF THESE SYSTEMS DISCHARGE TO THE ATMOSPHERE - BUT MANY DISCHARGE TO GAS HOLDERS - SOME TO RECOVERY AND SOME TO CLOSED TANKS
- ALMOST 100% HAVE A SHORTSTOP SYSTEM - MOST FEEL IT IS EFFECTIVE. SHORTSTOP CAN BE INJECTED EITHER MANUALLY OR AUTOMATICALLY
- ALL HAVE RECOVERY SYSTEMS AVAILABLE FOR RUN-AWAY BATCHES
- MOST HAVE SOME METHOD OF DISCHARGING LIQUID TO PREVENT FAILURES DUE TO HYDROSTATIC CONDITIONS

### IV. METHODS TO HANDLE A RUNAWAY BATCH

- COOLING - ADD WATER - OPERATOR INVOLVEMENT
- ADD SHORTSTOP
- VENT TO RECOVERY - GAS HOLDER - OR EMPTY VESSEL
- MANUALLY VENT REACTOR
- USE OF RUPTURE DISK & RELIEF VALVE TO VENT TO ATMOSPHERE

## V. SIZING OF RELIEF SYSTEMS

- ASME CODE FOR UNFIRED PRESSURE VESSELS - 100% VCM - FIRE CONDITION
- REACTION EXOTHERM AND NO COOLING
- VCM VAPORIZATION RATE REQUIRED TO REMOVE HEAT OF REACTION AT RELIEVING TEMPERATURE TIMES TWO. VAPOR FLOW WITH NO BACK PRESSURE
- FACTORY MUTUAL DATA SHEET EMERGENCY VENTING OF VESSELS
- BOYLES PAPER - MONSANTO FORMULA MAX. RATE OF REACTION AT TEMPERATURE EQUIVALENT TO PRESSURE OF RELIEF SYSTEM
- CORRECT REACTION KINETICS FOR THE TYPE OF PVC PRODUCED COMBINED WITH A VALID EQUATION FOR HANDLING A MULTIPHASE FLOW THROUGH THE RELIEVING SYSTEM
- SIMULATE LOSS OF COOLING, DETERMINE RELIEF REQUIRED CONSIDERING REACTOR KINETICS AND MULTIPHASE RELIEF FLOW. SIZE RELIEF SYSTEMS TO KEEP MAX. PRESSURE BELOW ASME CODE LIMITS.

Rupture Disk  
Nominal Size (in.)      Flow Area (in.<sup>2</sup>)

3                      7.393

4                      12.73

6                      28.89

8                      50.03

Relief Valve\*  
Nominal Size (in.)      Flow Area (in.<sup>2</sup>)

3 X 4                      1.287  
                                 2.853

4 X 6                      6.38

6 X 8                      11.05

6 X 10                      16.00

8 X 10                      26.00

\* Largest orifice size for that size valve.

PVC POLY SIZE RELIEF AREA COMPARISON

| <u>COMPANY AND<br/>LOCATION</u> | <u>POLY<br/>SIZE<br/>GAL</u> | <u>RATING PSIG</u> | <u>RELIEF<br/>NOZZLE<br/>SIZE</u> | <u>NUMBER</u> | <u>TOTAL<br/>AREA<br/>AVAILABLE</u> | <u>RELIEF<br/>AREA PER<br/>1000 GAL</u> |
|---------------------------------|------------------------------|--------------------|-----------------------------------|---------------|-------------------------------------|-----------------------------------------|
| 1.                              | 1,100                        | 200                | 2"                                | 1             | 3.14                                | 2.85                                    |
| 2.                              | 2,500                        | 200-400            | 4"                                | 1             | 12.56                               | 5.02                                    |
| 3.                              | 3,300                        | 250                | 4"                                | 1             | 12.56                               | 3.81                                    |
| 4.                              | 4,300                        | 300                | 4"                                | 1             | 12.56                               | 2.9                                     |
| 5.                              | 16,500                       | 240-300            | 10"                               | 1             | 78.5                                | 4.75                                    |
| 6.                              | 2,000                        | 180                | 3"                                | 1             | 7.07                                | 3.53                                    |
|                                 | 4,000                        | 180                | 3"                                | 1             | 7.07                                | 1.77                                    |
| 7.                              | 4,000                        | 200                | 4"                                | 1             | 12.56                               | 3.64                                    |
|                                 | 6,000                        | 200                | 4"                                | 1             | 12.56                               | 2.09                                    |
| 8.                              | 2,400                        | 200                | 4"                                | 1             | 12.56                               | 5.2                                     |
|                                 | 3,500                        | 185-200            | 4"                                | 1             | 12.56                               | 3.5                                     |
| 9.                              | 4,000                        | 200                | 4"                                | 1             | 12.56                               | 3.14                                    |
|                                 | 6,000                        | 220                | 4"                                | 1             | 12.56                               | 2.09                                    |
|                                 | 24,000                       | 200                | 18"                               | 1             | 254.34                              | 10.59                                   |
|                                 | 24,000                       | 180                | 16"                               | 1             | 200.96                              | 8.37                                    |
| 10.                             | 20,000                       | 260                | 16"                               | 1             | 200.96                              | 10.05                                   |

PVC POLY SIZE RELIEF AREA COMPARISON

| <u>COMPANY AND<br/>LOCATION</u> | <u>POLY<br/>SIZE<br/>GAL</u> | <u>RATING PSIG</u> | <u>RELIEF<br/>NOZZLE<br/>SIZE</u> | <u>NUMBER</u> | <u>TOTAL<br/>AREA<br/>AVAILABLE</u> | <u>RELIEF<br/>AREA PER<br/>1000 GAL</u> |
|---------------------------------|------------------------------|--------------------|-----------------------------------|---------------|-------------------------------------|-----------------------------------------|
| 11.                             | 35,000                       | 172                | 8"                                | 2             | 100.48                              | 2.87                                    |
| 12.                             | 35,000                       | 185                | 8"                                | 2             | 157                                 | 4.49                                    |
|                                 |                              |                    | 6"                                | 2             |                                     |                                         |
| 13.                             | 2,200                        | 200                | 4"                                | 1             | 12.56                               | 5.71                                    |
|                                 | 5,000                        | 225                | 6"                                | 1             | 28.26                               | 5.65                                    |
|                                 | 7,000                        | 200                | 6"                                | 1             | 28.26                               | 4.04                                    |
|                                 | 20,000                       | 225                | 8"                                | 2             | 100.48                              | 5.02                                    |
| 14.                             | 3,500                        | 300                | 6"                                | 1             | 28.26                               | 4.07                                    |
|                                 | 7,400                        | 250                | 6"                                | 1             | 28.26                               | 3.82                                    |
| 15.                             | 4,200                        | 200                | 4"                                | 1             | 12.56                               | 2.99                                    |
|                                 | 5,700                        | 200                | 4"                                | 1             | 12.56                               | 2.20                                    |
|                                 | 4,500                        | 200                | 3"                                | 1             | 7.07                                | 1.57                                    |
| 16.                             | 3,700                        | 200                | 4"                                | 1             | 12.56                               | 3.39                                    |
|                                 | 5,200                        | 200                | 6"                                | 1             | 28.26                               | 5.43                                    |
|                                 | 17,000                       | 165                | 8" x 12"                          | 2             | 213.52                              | 12.56                                   |
| 17.                             | 20,000                       | 200                | 6"                                | 2             |                                     |                                         |
|                                 |                              |                    | 8"                                | 1             | 107.16                              | 5.34                                    |

Note: Total relief area is based on full nozzle size for comparison and does not include the reduction of area if a relief valve is used.

2376E/wp/4

Recent Regulatory Action  
Related to Vinyl Chloride/PVC 9/29/80

OSHA

Carcinogen Policy

Issued 22 January

Candidate list of 250 issued August 11

Priority lists due next

In litigation, courts have ruled it a standard, but retained in 5th circuit.

Benzene standard overturned - requires some proof of need. No comment  
on cost benefit. Coke oven case withdrawn, cotton dust standard  
review granted.

Rate Retention

Lead standard upheld

Medical Records Access

Issued 23 May. Exposure and health data

Litigated by La. Chem. Assn.

Fire Brigade Standard

Issued 12 September

Walk-Around Pay

Remanded by courts

Labeling

Proposal past due

Refusal of Inspection

Court cases mixed

OSHA proposed ex parte warrants

General Duty Citations

None known in PVC/VC industry, but used in others

Women in Work Place

Am. Cyanamid charges dismissed, Bunker Hill charged

DOL/EEOC proposal on reproductive hazards - comment period over

Reopening of Standard

NIOSH/OSHA Symposium at Bethesda in March

Strong effort to implicate similar compounds and PVC dust, but no new data.

Maltoni data showed NOEL

Project officer assigned

EPA

Carcinogen Policy

Hearings in March

Two-track activity

- Scientific principles and 6 candidates under review by SAB

- Using philosophy in VC, radio nuclides, water quality criteria, labeling,  
etc.

Record still open

Carcinogen list released (150/100)

NGC 23251

EPA (cont'd)

Vinyl Chloride Revisions

Five-year review underway by TRW

EPA still says depends on carcinogen policy decision

Emergency Releases major issue

General Fugative Emissions Rule

Due soon - similar to VC

Labeling

Proposal due soon

List released (100)

Water Quality Criteria

No further action

RCRA

Now effective - manifest system

Many chlorinated materials listed

Reactor scraps due to be listed in November

DOT

Identification System

Adopted - VC = UN1086

Retrofit of Tank Cars

HM-175 would bring 105 cars up to same standard as 112 type

Hazardous Wastes

Memo of Agreement with EPA - Proposals in May 22 FR

FDA

No action on PVC packaging.

Monsanto/Acrylo decision prompted SPI to reapply for liquor bottles.

NCI

Phthalates and adipates found carcinogenic in rodents

IRLG Agencies

Agreement for cross-inspection by agents

PVC POLY SIZE RELIEF AREA COMPARISON

| <u>BFG Plants</u>  | <u>POLY<br/>SIZE<br/>GAL</u> | <u>RATING PSIG</u> | <u>RELIEF<br/>NOZZLE<br/>SIZE</u> | <u>NUMBER</u> | <u>TOTAL<br/>AREA<br/>AVAILABLE</u> | <u>RELIEF<br/>AREA PER<br/>1000 GAL</u> |
|--------------------|------------------------------|--------------------|-----------------------------------|---------------|-------------------------------------|-----------------------------------------|
| LVL BLD I          | 1,100                        | 200                | 2"                                | 1             | 3.14                                | 2.85                                    |
| L.B.               | 2,500                        | 200-400            | 4"                                | 1             | 12.56                               | 5.02                                    |
| Henry              | 3,300                        | 250                | 4"                                | 1             | 12.56                               | 3.81                                    |
| PT-ALE             | 4,300                        | 300                | 4"                                | 1             | 12.56                               | 2.9                                     |
| Niagara & LVL-LPA  | 16,500                       | 240-300            | 10"                               | 1             | 78.5                                | 4.75                                    |
| PT-LPA             | 18,600                       | 240                | 12"                               | 1             | 113.04                              | 6.08                                    |
| Convent            | 39,600                       | —                  | 18 & 16                           | 2             | 455.3                               | 11.49                                   |
| <u>COMPETITORS</u> |                              |                    |                                   |               |                                     |                                         |
| Keysor             | 2,000                        | 180                | 3"                                | 1             | 7.07                                | 3.53                                    |
|                    | 4,000                        | 180                | 3"                                | 1             | 7.07                                | 1.77                                    |
| Gen Tire           | 4,000                        | 200                | 4"                                | 1             | 12.56                               | 3.64                                    |
|                    | 6,000                        | 200                | 4"                                | 1             | 12.56                               | 2.09                                    |
| PVC Plant          | 2,400                        | 200                | 4"                                | 1             | 12.56                               | 5.2                                     |
|                    | 3,500                        | 185-200            | 4"                                | 1             | 12.56                               | 3.5                                     |
| Air Products       | 4,000                        | 200                | 4"                                | 1             | 12.56                               | 3.14                                    |
|                    | 6,000                        | 220                | 4"                                | 1             | 12.56                               | 2.09                                    |
|                    | 24,000                       | 200                | 18"                               | 1             | 254.34                              | 10.59                                   |
|                    | 24,000                       | 180                | 16"                               | 1             | 200.96                              | 8.37                                    |
| Georgia Pacific    | 20,000                       | 260                | 16"                               | 1             | 200.96                              | 10.05                                   |
| Shintech           | 35,000                       | 172                | 8"                                | 2             | 100.48                              | 2.87                                    |

NGC 23253

PVC POLY SIZE RELIEF AREA COMPARISON

| <u>COMPETITORS (CONT.)</u> | <u>POLY<br/>SIZE<br/>GAL</u> | <u>RATING PSIG</u> | <u>RELIEF<br/>NOZZLE<br/>SIZE</u> | <u>NUMBER</u> | <u>TOTAL<br/>AREA<br/>AVAILABLE</u> | <u>RELIEF<br/>AREA PER<br/>1000 GAL</u> |
|----------------------------|------------------------------|--------------------|-----------------------------------|---------------|-------------------------------------|-----------------------------------------|
| Tenneco or Firestone       | 35,000                       | 185                | 8"                                | 2             | 157                                 | 4.49                                    |
|                            |                              |                    | 6"                                | 2             |                                     |                                         |
| Diamond                    | 2,200                        | 200                | 4"                                | 1             | 12.56                               | 5.71                                    |
|                            | 5,000                        | 225                | 6"                                | 1             | 28.26                               | 5.65                                    |
|                            | 7,000                        | 200                | 6"                                | 1             | 28.26                               | 4.04                                    |
|                            | 20,000                       | 225                | 8"                                | 2             | 100.48                              | 5.02                                    |
| Ethyl                      | 3,500                        | 300                | 6"                                | 1             | 28.26                               | 4.07                                    |
|                            | 7,400                        | 250                | 6"                                | 1             | 28.26                               | 3.82                                    |
| PVC - Company              | 4,200                        | 200                | 4"                                | 1             | 12.56                               | 2.99                                    |
|                            | 5,700                        | 200                | 4"                                | 1             | 12.56                               | 2.20                                    |
|                            | 4,500                        | 200                | 3"                                | 1             | 7.07                                | 1.57                                    |

NGC 23254

Note: Total relief area is based on full nozzle size for comparison and does not include the reduction of area if a relief valve is used.