Appendix B

Relief Valve Group Factual Report

Jacobs Engineering Group Contingency Analysis
Dated July 18, 1997

Bellingham, WA
DCA 99 MP 008

Contingency Analysis

By: Terri Quintana **Date: July 18, 1997**

System Protected: Product Inlet and Outlet Lines **P&ID: D-1902-D**

Relief Device: RV-1919, 1923, 1932, 1941

Set Pressure: 740 psig **System MAWP: 740 psig @ 100 °F**

The design of the relief system was examined for a total of 16 possible contingencies. The contingency(s) listed below apply to this system.

Surge

A surge from the Ferndale or Anacortes inlet or from Allen Station through the outlet lines potentially result in pressures exceeding the maximum allowable operating pressures for 300# rated piping. Full flow relief valves will be used to protect the piping during this condition.

The discharge of the relief valve will be piped to the transmix tank, TK-209. It is possible that the normal process operation of sending product to TK-209 may be occurring simultaneously with a surge relief condition on the other inlet line. This will result in a flowrate double the design flow through the process line. The transmix header was originally designed to be a 16-inch line. Due to the backpressure during a relief, either a pilot operated 8 X 10 valve would be required or if the transmix line is changed to 20-inch line a conventional 6 X 8 valve may be used.

Conclusions

1. The main limitations of pilot operated relief valves are viscous and dirty services which can clog pilots.
2. Diesel may be considered a dirty service.
3. Minimal price difference involved in installing 20" versus 16" line (approx. $13,000).

Recommendations

1. Install 20" transmix line and install 6 x 8 conventional relief valve in this service.

From Bayview Products Terminal "Process Calculation Manual" Jan. 1999.

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MEMORANDUM

July 1997
~~April 7, 1998~~

TO: Ron Reed/ Karen Grauel

FROM: Terri Quintana

PROJECT NO. 05P88101

SUBJECT: Full Flow Surge Relief Requirement at Storage Tanks

During the Process Safety Review meeting it was recommended that full flow relief valves be considered for the inlet/outlet lines to the storage tanks. The scenarios that I looked at for these relief valves are the following: 1) product being pumped into the storage tank from Ferndale or Anacortes and tank inlet valve in the closed position, and 2) surge with tank inlet valve closed. The event of having the inlet valve closed and the manifold valve open may happen if the inlet valve is put into manual mode.

For the first scenario, Ferndale and Anacortes pump curves were evaluated to see if their shut in pressure is greater than the allowable working pressure for 150# piping flange class of 285 psig. There are three pumps at Ferndale, 2 of the 3 have shut in pressures greater than 285 psig (Ferndale #2 and #3). Both pumps at Anacortes have shut in pressures less than 285 psig. A relief valve is required to protect the line from overpressure in this scenario due to the pumps shut in pressure at Ferndale. The relief valve needs to be sized for the design flow rate of12,000 BPH

For the second scenario, the surge may have been caused by the tank inlet valve closing which would result in the same shut in pressure as the first scenario. Therefore, using the same convention for scenario one sizing for surge relief, a full flow relief valve would be required.

Added RV-2065
RV-2082
RV-2072
RV-2077
RV-2088

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0001034 4

To learn about this application press F5 then type INFO

TAG/EQUIP. NUMBER	Various	UNIT SERVICE:	Surge protection for 300# pipeline	P&ID:	D-1902	LOCATION:	COST CENTER:
EQUIPMENT PROTECTED	Pipeline 300# rating	SET PRESS:	740 PSIG	BASIS:	Surge	Ksh(Vap)=	1.000
EXISTING RV AREAS:	1.0 / 2.0 / 3.0 / 4.0	DISCHARGE DISPOSITION:	RELIEF HEADER			Kd(liq) =	0.740
CALCULATION METHOD (ASME OR API), 1 OR 2 =	2	Multiple Valves, (2=YES)	1.0	CONSTANT BACKPRESSURE: PSIG	VARIABLE BACK PRESS.: PSIG	Kd(vap) =	0.950
EQUIPMENT DESIGN CONDITIONS: ( ) MAWP (X) DESIGN ( ) OTHER		Is this a steam vlv,y/n :	N	BUILT-UP BACKPRESSURE: 39.0 PSIG	TOTAL BACKPRESSURE: 39.0 PSIG	Kb =	1.000
NORMAL OPER.	PSIG °F	Rupture Disk ,Y/N	N	FIRE SUMMARY	WETTED AREA: FT²	Is This a Bellows Type y/n =	N
MAX OPER.	PSIG °F	Derating Factor=	0.9	INSULATION N	TYPE HC / THCKNS IN.	Insul factr, 1=none	1.000
DESIGN	740 PSIG 100 °F			Q = Note from fire case MM btu/Hr		Certified Valve? Y/N =	n
CONN: RATING, FACING	300 #	PIPE SPEC:		ATTACH SKETCH FOR AREA CALCULATION:	(Note: see back up material)		
Exist. RV	MFG / Type / Size						

CONTINGENCY ANALYSIS CHECKLIST

(REFER TO API RP520 & RP521 AND JACOBS SAFETY MANUAL)

			RELIEF LOAD		RELIEF (2) CONDITIONS		FLUID PHYSICAL PROPERTIES AT RELIEF CONDITIONS.										
	Comments NA, etc	% OV PR	VAPOR M#/HR	LIQUID GPM	PRESS PSIG	TEMP °F	FLUID TYPE	VAPOR MOL WT	SP GRAVITY LIQUID	COMPR FACTOR Z	LATENT HEAT L	SP HEAT RATIO k	LIQUID VISC LCP	VAPOR VISC VCP	VAPOR AREA V IN²	LIQUID AREA L IN²	TOTAL AREA T IN²
1. BLOCKED OUTLETS		10.0															
2. ABNORMAL HEAT INPUT	Not Applicable	10.0															
3. EXCHANGER TUBE BREAKAGE	Not Applicable	10.0															
4. AUTO CONTROL FAILURE - surge	Controlling	10.0		8,400.0	740.0	75.0	Diesel		0.870	1.000			3.70			15.783	15.78[illegible]
5. REFLUX FAILURE	Not Applicable	10.0															
6. FIRE	Not Applicable	21.0															
7. TEMPERED WATER FAILURE	Not Applicable	10.0															
8. POWER FAILURE		10.0															
9. INSTR. AIR FAILURE	Not Applicable	10.0															
10. INADVERTENT VA. OPEN	Not Applicable	10.0															
11. MECH. EQUIP. FAILURE	Not Applicable	10.0															
12. HEAT LOSS (SERIES FRAC.)	Not Applicable	10.0															
13. THERMAL	Not Applicable	10.0															
14. LOSS OF QUENCH/COLD FEED	Not Applicable	10.0															
15. CHEMICAL REACTION	Not Applicable	10.0															
16. STEAM OUT	Not Applicable	10.0															
17. STEAM VALVE (ASME) EQUATION	Not Applicable	10.0															
18. PRD'S CAPACITY		10.0															

NOTES: (1)
(2)

GENERAL DATA	BY/DATE	TO/	4/7/98
PROCESS DATA	BY/DATE	TO/	4/7/98
VALVE SIZING	BY/DATE	TO/	4/7/98

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SIZING CASE SELECTED A, IN^2:	Surge	15.783	RELIEF DEVICE ORIFICES TYPE: R			TOTAL ORIFICE AREA REQD:	16.000 SQUARE INCHES			Olympic Pipe Line	
DEVICES SELECTED:	QTY: 1	INLET 6"	OUTLET 8"			ORIFICE/AREA (1):	16.000	SET PRESS:	740 PSIG	Pressure Relief Device	
	QTY:	INLET	OUTLET			ORIFICE/AREA (1):		SET PRESS:	PSIG	Process Selection Basis	Surge
	QTY:	INLET	OUTLET			ORIFICE/AREA (1):		SET PRESS:		Device: Various	Rev. 0

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TAG/EQUIP. NUMBER: Various	UNIT SERVICE: Surge protection for 300# pipeline		P&ID: D-1902	LOCATION:	COST CENTER:
EQUIPMENT PROTECTED: Pipeline 300# rating		SET PRESS: 749 PSIG	BASIS: Surge		Ksh(Vap)= 1.000
EXISTING RV AREAS: 1.0 / 2.0 / 3.0 / 4.0		DISCHARGE DISPOSITION: RELIEF HEADER			Kd(liq) = 0.740
CALCULATION METHOD (ASME OR API), 1 OR 2 = 2	Multiple Valves, (2=YES) 1.0	CONSTANT BACKPRESSURE: PSIG	VARIABLE BACK PRESS.: PSIG		Kd(vap) = 0.950
EQUIPMENT DESIGN CONDITIONS: ( ) MAWP (X) DESIGN ( ) OTHER	Is this a steam vlv,y/n: N	BUILT-UP BACKPRESSURE: 61.7 PSIG	TOTAL BACKPRESSURE: 61.7 PSIG		Kb = 1.000
NORMAL OPER. PSIG / 329 °F	Rupture Disk ,Y/N N	FIRE SUMMARY	WETTED AREA: FT²		Is This a Bellows Type y/n = N
MAX OPER. PSIG / °F	Derating Factor= 0.9	INSULATION N	TYPE HC	THCKNS IN.	Insul factr, 1=none 1.000
DESIGN 740 PSIG / 400 °F		Q = Note from fire case MM btu/Hr			Certified Valve? Y/N = n
CONN: RATING, FACING 300 #	PIPE SPEC:	ATTACH SKETCH FOR AREA CALCULATION:	(Note: see back up material)		
Exist. RV MFG Type Size					

CONTINGENCY ANALYSIS CHECKLIST

(REFER TO API RP520 & RP521 AND JACOBS SAFETY MANUAL)

	Comments NA, etc	% OV PR	RELIEF LOAD VAPOR #/HR	RELIEF LOAD LIQUID GPM	RELIEF (2) CONDITIONS PRESS PSIG	RELIEF (2) CONDITIONS TEMP °F	FLUID TYPE	VAPOR MOL WT	SP GRAVITY LIQUID	COMPR FACTOR Z	LATENT HEAT L	SP HEAT RATIO k	LIQUID VISC LCP	VAPOR VISC VCP	VAPOR AREA V IN²	LIQUID AREA L IN²	TOTAL AREA T IN²
1. BLOCKED OUTLETS		10.0															
2. ABNORMAL HEAT INPUT	Not Applicable	10.0															
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16. STEAM OUT	Not Applicable	10.0															
17. STEAM VALVE (ASME) EQUATION	Not Applicable	10.0															
18. PRD'S CAPACITY		10.0															

NOTES: (1)

(2)

GENERAL DATA	BY/DATE	TO/ 4/7/98
PROCESS DATA	BY/DATE	TO/ 4/7/98
VALVE SIZING	BY/DATE	TO/ 4/7/98

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SIZING CASE SELECTED A, IN^2: Surge 15.989	RELIEF DEVICE ORIFICES TYPE: R		TOTAL ORIFICE AREA REQD: 16.000 SQUARE INCHES			Olympic Pipe Line
DEVICES SELECTED: QTY: 1	INLET 6"	OUTLET 8"	ORIFICE/AREA (1): 16.000	SET PRESS: 740	PSIG	Pressure Relief Device
QTY:	INLET	OUTLET	ORIFICE/AREA (1):	SET PRESS:	PSIG	Process Selection Basis Surge
QTY:	INLET	OUTLET	ORIFICE/AREA (1):	SET PRESS:		Owner: Various Rev. 0