Compressor Station

HP Relief Header and Flare Evaluation

Revision A

December 2024

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Recommendation Summary

1. A 12” detonation arrestor is present at the entrance to the flare stack. As the arrestor can potentially plug and compromise the ability of the relief valves to safely relieve it is recommended to remove the arrestor. Note that per API STD 521, stoichiometric mixtures of hydrocarbon and air can produce pressures on the order of 7 to 8 times absolute operating pressure in the event of an explosion which would be roughly 100 psig. The knockout drum has a MAWP of 150 psig, therefore no loss of containment would be expected even if an explosion/deflagration occurred.

2. For the blocked facility outlet case, the maximum droplet size that could pass through the knockout drum is predicted to be 723 microns which exceeds the 300 – 600 micron recommended range. As the blocked facility outlet scenario assumes that 3 out of 5 compressors fail to shutdown on 3rd stage discharge PAHH, this scenario is very unlikely. As such, it is recommended that Targa consider the risk associated with this result prior to any physical changes.

Study Description

The relief header and flare system was evaluated to determine adequacy for scenarios that resulted in multiple, simultaneous releases to the system as well as single, large releases. The relief loads were determined based on standards, API STD 521 and standard engineering practices. Based on a review of the facility, the scenarios under consideration are a blocked facility outlet and several external fire scenarios impacting multiple pieces of equipment. These scenarios were quantified with the basic assumptions below:

- The external fire relief scenarios and loads were evaluated per API STD 521 and the following assumptions:
    - Adequate drainage is not present resulting in the use of the 34,500 factor in the heat flux equation as opposed to 21,000.
    - The latent heat was based on vaporization of the first 5% of the liquid by mass with all sensible heat removed.
    - The liquid levels were generally based on LSHH set points or other conservative assumptions if a LSHH was not present.
    - Vapor expansion cases were conservatively evaluated based on the maximum expected operating pressure which was typically the PSHH set point.
    - Vapor expansion cases are much more transient than boiling liquid cases, however the peak expansion relief load from each source was assumed to occur simultaneously.

- The maximum extent of an external fire is 5,000 ft^2 which was applied as a 80' diameter fire circle.

- The blocked outlet loads from the compressors were based on the mechanical characteristics of the compressor with minimum clearance and maximum suction pressure (PSHH set point). The compressors were assumed to relieve from the 3rd stage.

Relief Header Design Criteria

The primary constraint for the relief header piping is that developed back pressures in the header during these scenarios do not result in adverse operation or impact on capacity of any of the relief valves or blowdown valves involved in scenario. The back pressure profile for the relief header was determined based on a piping sketch that was developed by field walkdown (see Appendix A). A hydraulic model of the system predicated on a node and segment system was then prepared. The back pressure at each flowing device was determined and compared to established limits based on the type of device. Per the original flare specifications, the flare tip pressure drop is 0.82 psi @ 28.4 MMSCFD. The flare tip pressure drop was conservatively set to 2 psig for all scenarios. In general, the back pressure limitations in terms of percentage of set pressure are as follows:

Conventional relief valves – 10% of set pressure for process cases, 21% of set pressure for fire cases

Bellows relief valves – 30% (vapor) or 17% (liquid) of set pressure above which capacity must be de-rated

Pilot-operated relief valves, control valves and blowdown valves - ~50% of inlet pressure (vapor) above which capacity must be de-rated for sub-critical flow

The relief header evaluation is based on the required relief loads. The individual relief valve tail pipes have already been evaluated based on the actual relief device capacity, and the calculations are documented in the individual relief device binders.

Knockout Drum Design Criteria

The primary constraints for the flare knockout drum are droplet separation and liquid retention which in both cases have the objective of eliminating liquid flow to the flare. Per API STD 521, "Long-term field experience has shown that the dropout velocity in the drum may be based on that necessary to separate droplets from 300 microns to 600 microns in diameter." Also per API STD 521, the liquid retention time (hold-up) "should be based on a release that lasts 20-30 minutes." The Flare Knockout Drum (V-1920) is 72" in diameter by 20' seam-to-seam and the inlet and outlet nozzles are separated by approximately 17'. The knockout drum is emptied by P-1941 which is controlled in an on/off fashion by LIT-1920 which is set to come on at 14% level and shut-off at 7% level. In addition, LIT-1920 has a high level alarm at 30%. As no scenarios with significant liquid flow to the knockout drum were identified, liquid retention is not an issue for the knockout drum.

The droplet separation efficiency was evaluated based on GPSA equations for horizontal separation equipment with no mesh pad. The terminal droplet velocity was equated to the gas velocity to determine the minimum droplet size that the Knockout Drum could separate. As there are no free liquids associated with any of the scenarios, a liquid density of 40.0 lb/ft^3 was assumed and liquid retention time is not applicable. The stated droplet separation efficiencies are based on the drum being at 14% level (pump off set point) which was found to be the worst case as compared to the low level of 7% and high alarm level of 30%. The drawing and U1-A form for the Flare Knockout Drum are presented in Appendix B.

Flare Design Criteria

The exit velocity is dictated by the diameter of the flare and volumetric flow. The maximum tolerable exit velocity is dependent on the particular flare and possibly the gas composition. For a typical pipe flare, API STD 521 states, “Many pipe flares, assisted or unassisted, and air assisted flares have been in service for years with Mach numbers ranging from Mach 0.8 and higher.” As this statement indicates, there is not an exact limit on the flare exit velocity. Per the original flare design, the worst case design condition was based on 28.4 MMSCFD of 21.43 MW gas at -8° F that results in Mach 0.25 and 0.82 psi pressure drop at the tip exit. Note that the scenario resulting in this original design basis is not known. This design case was used to calibrate the fraction heat radiated factor (F) with the closest match found to be at F = 0.16. Note that F = 0.3 is often quoted as a conservative default value.

The height of the flare is dictated by ensuring acceptable radiation levels at grade which is also somewhat subjective. The following table from API STD 521 provides some guidance on the time to reach the threshold of pain at differing radiation levels. Note that these values are based on direct skin exposure.

Radiation Level (Btu/ft2/hr)	Time to Pain Threshold (seconds)
550	60
740	40
920	30
1500	16
2200	9
3000	6
3700	4
6300	2

1,500 Btu/hr/ft2 is often quoted as a maximum radiation limit and is described as the maximum radiant heat intensity in areas where emergency actions lasting 2 to 3 minutes can occur with appropriate clothing. In this case, where egress from the area is the only objective, relatively higher radiation levels are more tolerable. Per the vendor specifications, the maximum radiation at grade is 1,200 Btu/ft^2/hr for the aforementioned design case excluding solar radiation which is typically a maximum of 300 Btu/ft^2/hr.

The Flare (FL-1901) is a Flare King Model EKVAP-H100-R22S-EPTKA which has a 14" Flare King utility flare tip, 44 BHP Blower and overall height of 100' The original specification sheet and flare drawing are presented in Appendix B. Flare radiation profiles were quantified using the Brzustowski and Sommer methodology as outlined in API STD 521. The table below summarizes the four scenarios that were evaluated.

Scenario	Mass Flow (lb/hr)	MW	Temp. (F)	Tip Exit Mach No.	Max Rad. (Btu/hr/ft2)	Max. KO Droplet Size
Blocked Facility Outlet	189,329	21.8	194	0.88	2,200	723
Fire Zone #1 – C-1051 & 1052	38,319	49.7	499	0.14	700	147
Fire Zone #2 – Sulfatreat Area	75,560	21.8	152	0.34	1,100	317
Fire Zone #3 – Closed Drain Tank Area	213,432	73.1	352	0.60	2,600	463

Relief Header, Knock Drum and Flare Design Scenarios

Based on the detailed review of all the individual relief devices along with other sources that feed the relief header and flare system, the following scenarios were selected for evaluation. The relief load calculations are included in the Appendices and more details on the relief valves can be found in the individual relief valve documentation binders.

Blocked Facility Outlet – 3 of 5 Compressors Running (C-1051, 1052 & 1057)

In the event that the facility outlet is blocked, the compressor discharge pressure and pressure through the high pressure gas equipment will increase. In the event that the compressors do not shut down on 3rd stage discharge PAHH, overpressure could occur with each compressor 3rd stage relief valve discharging at its required relief rate. The analysis was based on 3 of the 5 compressors (C-1051, C-1052 and C-1057) not shutting down which given a typical probability of failure on demand (PFOD) of 10% for pressure transmitters makes this scenario unlikely (0.5% chance) but conservative. As described above, the relief loads for the 3rd stage discharge PSVs were based on the mechanical characteristics of the compressor, minimum clearances and suction pressure at the 2nd stage discharge PSHH set point. The relief loads are therefore conservative.

Detailed relief load, relief header hydraulic, knockout drum separation, flare exit velocity and flare radiation calculations are detailed in Appendix C. The relief load and fluid properties are summarized in the table below.

PSV Tag	Eq. Tag	Eq. Description	Fire Load (MMSCFD)	Relief P (psig)	Relief T (F)	Relief MW
PSV-1051A	V-9432 (C-1051)	C-1051 3rd Stage Discharge	19.65	1,584	260	21.8
PSV-1052A	V-9432 (C-1052)	C-1052 3rd Stage Discharge	19.65	1,584	260	21.8
PSV-1057A	V-9432 (C-1057)	C-1057 3rd Stage Discharge	10.11	1,584	270	21.8

Hydraulic Results

The table below summarizes the hydraulic results for the Blocked Facility Outlet Scenario.

Tag	Drawing	Device Size	Device Type	Set P (psig)	Back P (psig)	Back P (% set)
PSV-1051A	D-2415-F03C	2H3	Conventional	1,440	93.7	6.5
PSV-1052A	D-2415-F04C	2H3	Conventional	1,440	93.7	6.5
PSV-1057A	D-2415-F09C	2F3	Conventional	1,440	44.1	3.1

The back pressures are all below 10% of set pressure and, therefore, acceptable.

Knockout Drum Results

The knockout drum is capable of separating droplets greater than 723 microns based on the total flow of 79.1 MMSCFD and conditions of 6.8 psig and 195^{o} F. This is slightly above the API STD 521 recommended range of 300 to 600 microns. Given the very low probability of this scenario as described above Targa should consider accepting this result.

Flare Results

The exit velocity from the flare tip is 0.88 Mach and the maximum radiation at grade is 2,200 Btu/hr/ft^2 at approximately 151' from the base of the flare stack. As the flare is located in a relatively remote location and the only requirement is for personnel to be able to escape the area, the radiation levels are acceptable.

External Fire C-1051 and C-1052 (Fire Zone #1)

Per API RP 521, an area of between 2,500 ft^2 and 5,000 ft^2 should be considered when determining the potential for multiple relief valves to relieve in the event of an external fire. C-1051 through C-1054 have roughly the same spacing with any two adjacent compressors potentially being in the same fire zone. As C-1051 and C-1052 are hydraulically furthest from the flare, the equipment and relief devices associated with these two compressors were selected for analysis. The new relief valves associated with the 1st Stage Suction Scrubbers were included with an estimated routing of 3" discharge piping to the 8" subheader. The fire relief load associated with the 3rd stage discharge is based on vapor expansion as compared to the other relief loads that are based on vaporization of hydrocarbon liquids. Finally, it has been recommended to replace PSV-1051C with a 4P6 modulating pilot relief valve, but this change will not impact the piping or this evaluation. A plot plan identifying all the fire zones is presented in Appendix G.

Detailed relief load, relief header hydraulic, knockout drum separation, flare exit velocity and flare radiation calculations are detailed in Appendix D. The loads and fluid properties are summarized in the table below.

PSV Tag	Eq. Tag	Eq. Description	Fire Load (lb/hr)	Relief P (psig)	Relief T (F)	Relief MW
PSV-1051 (New)	V-9410	C-1051 1st Suction Scrubber	8,910	326.7	497.3	89.3
PSV-1051A	V-9432	C-1051 3rd Discharge Bottle	1,428	1,742.4	435.0	21.8
PSV-1051B	V-9430	C-1051 3rd Suction Scrubber	4,628	780.5	284.0	34.9
PSV-1051C	V-9420	C-1051 2nd Suction Scrubber	3,870	302.5	377.3	56.6
PSV-1051E	F-3052	C-1051 Fuel Gas Filter	323.7	302.5	377.3	56.6
PSV-1052 (New)	V-9410	C-1052 1st Suction Scrubber	8,910	326.7	497.3	89.3
PSV-1052A	V-9432	C-1052 3rd Discharge Bottle	1,428	1,742.4	435.0	21.8
PSV-1052B	V-9430	C-1052 3rd Suction Scrubber	4,628	780.5	284.0	34.9
PSV-1052C	V-9420	C-1052 2nd Suction Scrubber	3,870	302.5	377.3	56.6
PSV-1052E	F-3052	C-1052 Fuel Gas Filter	323.7	302.5	377.3	56.6

Hydraulic Results

The table below summarizes the hydraulic results for the Fire Zone #1 Scenario.

Tag	Drawing	Device Size	Device Type	Set P (psig)	Back P (psig)	Back P (% set)
PSV-1051 (New)	D-2415-F03A	2J3	Pilot Operated	270	7.0	2.6
PSV-1051A	D-2415-F03C	2F3	Conventional	1,440	4.6	0.3
PSV-1051B	D-2415-F03B	3K4	Conventional	645	4.8	0.7
PSV-1051C	D-2415-F03A	4M6	Conventional	250	4.6	1.8
PSV-1051E	D-2415-F03F	1E1	Conventional	175	6.5	3.7
PSV-1052 (New)	D-2415-F04A	2J3	Pilot Operated	270	6.9	2.6
PSV-1052A	D-2415-F04C	2F3	Conventional	1,440	4.4	0.3
PSV-1052B	D-2415-F04B	3K4	Conventional	645	4.7	0.7
PSV-1052C	D-2415-F04A	4M6	Conventional	250	4.5	1.8
PSV-1052E	D-2415-F04F	1E1	Conventional	175	6.5	3.7

The back pressures on all relief valves are well below 21% of set pressure and, therefore, acceptable.

Knockout Drum Results

The knockout drum is capable of separating droplets greater than 147 microns based on the total flow of 7.0 MMSCFD and conditions of 2.2 psig and 499^{o} F. This is below the API STD 521 recommended range of 300 to 600 microns and, therefore, acceptable.

Flare Results

The exit velocity from the flare tip is 0.14 Mach and the maximum radiation at grade is 700 Btu/hr/ft^2 at approximately 45' from the base of the flare stack. As the flare is located in a relatively remote location and the only requirement is for personnel to be able to escape the area, the radiation levels are acceptable.

External Fire Sulfatreat Vessels (Fire Zone #2)

Per API RP 521, an area of between 2,500 ft^2 and 5,000 ft^2 should be considered when determining the potential for multiple relief valves to relieve in the event of an external fire. All four Sulfatreat Vessels are within the same fire zone and were assumed to relieve at the peak vapor expansion rate simultaneously. A plot plan identifying all the fire zones is presented in Appendix G.

Detailed relief load, relief header hydraulic, knockout drum separation, flare exit velocity and flare radiation calculations are detailed in Appendix E. The loads and fluid properties are summarized in the table below.

PSV Tag	Eq. Tag	Eq. Description	Fire Load (lb/hr)	Relief P (psig)	Relief T (F)	Relief MW
PSV-1811	V-1811	Sulfatreat Vessel	18,890	1742.4	234.5	21.8
PSV-1812	V-1812	Sulfatreat Vessel	18,890	1742.4	234.5	21.8
PSV-1813	V-1813	Sulfatreat Vessel	18,890	1742.4	234.5	21.8
PSV-1814	V-1814	Sulfatreat Vessel	18,890	1742.4	234.5	21.8

Hydraulic Results

The table below summarizes the hydraulic results for Fire Zone #2 scenario.

Tag	Drawing	Device Size	Device Type	Set P (psig)	Back P (psig)	Back P (% set)
PSV-1811	D-2415-F14	1.5F2	Conventional	1,440	164.1	11.4
PSV-1812	D-2415-F14	1.5F2	Conventional	1,440	168.6	11.7
PSV-1813	D-2415-F14	1.5F2	Conventional	1,440	170.4	11.8
PSV-1814	D-2415-F14	1.5F2	Conventional	1,440	170.9	11.9

The back pressures on these conventional relief valves are below 21% of set pressure which is the limit for external fire scenarios and, therefore, acceptable.

Knockout Drum Results

The knockout drum is capable of separating droplets greater than 317 microns based on the total flow of 31.6 MMSCFD and conditions of 2.4 psig and 152^o F. This is within the API STD 521 recommended range of 300 to 600 microns and, therefore, acceptable.

Flare Results

The exit velocity from the flare tip is 0.34 Mach and the maximum radiation at grade is 1,100 Btu/hr/ft^2 at approximately 135' from the base of the flare stack. As the flare is located in a relatively remote location and the only requirement is for personnel to be able to escape the area, the radiation levels are acceptable.

External Fire Closed Drain Tank Area (Fire Zone #3)

Per API RP 521, an area of between 2,500 ft^2 and 5,000 ft^2 should be considered when determining the potential for multiple relief valves to relieve in the event of an external fire. The Closed Drain Tank, and Condensate Flash are within the same fire zone. Note that the TEG Contactor and TEG Overhead Scrubber are also in this fire zone but relieve to atmosphere. It has been recommended to replace PSV-1912 with a 3" x 4" full-bore modulating pilot operated relief valve and PSV-1917 with a 2" x 3" full-bore modulating pilot operated relief valve, but these change will not impact the discharge piping or the analysis. A plot plan identifying all the fire zones is presented in Appendix G.

Detailed relief load, relief header hydraulic, knockout drum separation, flare exit velocity and flare radiation calculations are detailed in Appendix F. The loads and fluid properties are summarized in the table below.

PSV Tag	Eq. Tag	Eq. Description	Fire Load (lb/hr)	Relief P (psig)	Relief T (F)	Relief MW
PSV-1912	V-1912	Closed Drain Tank	130,705	302.5	385.6	72.5
PSV-1917	V-1917	Condensate Flash Tank	82,727	332.8	400.2	74.1

Hydraulic Results

The table below summarizes the hydraulic results for the Fire Zone #3 scenario.

Tag	Drawing	Device Size	Device Type	Set P (psig)	Back P (psig)	Back P (% set)
PSV-1912[1]	D-2415-F23	3FB4	Pilot Operated	250	131.6	52.6
PSV-1917[1]	D-2415-F24A	2FB3	Pilot Operated	275	147.0	53.5

[1] Relief valve size and type is based on proposed replacement relief valve. Current relief valves are undersized.

The back pressures on these pilot-operated relief valves are below the critical to subcritical transition ratio and, therefore, acceptable as no capacity de-rate is required.

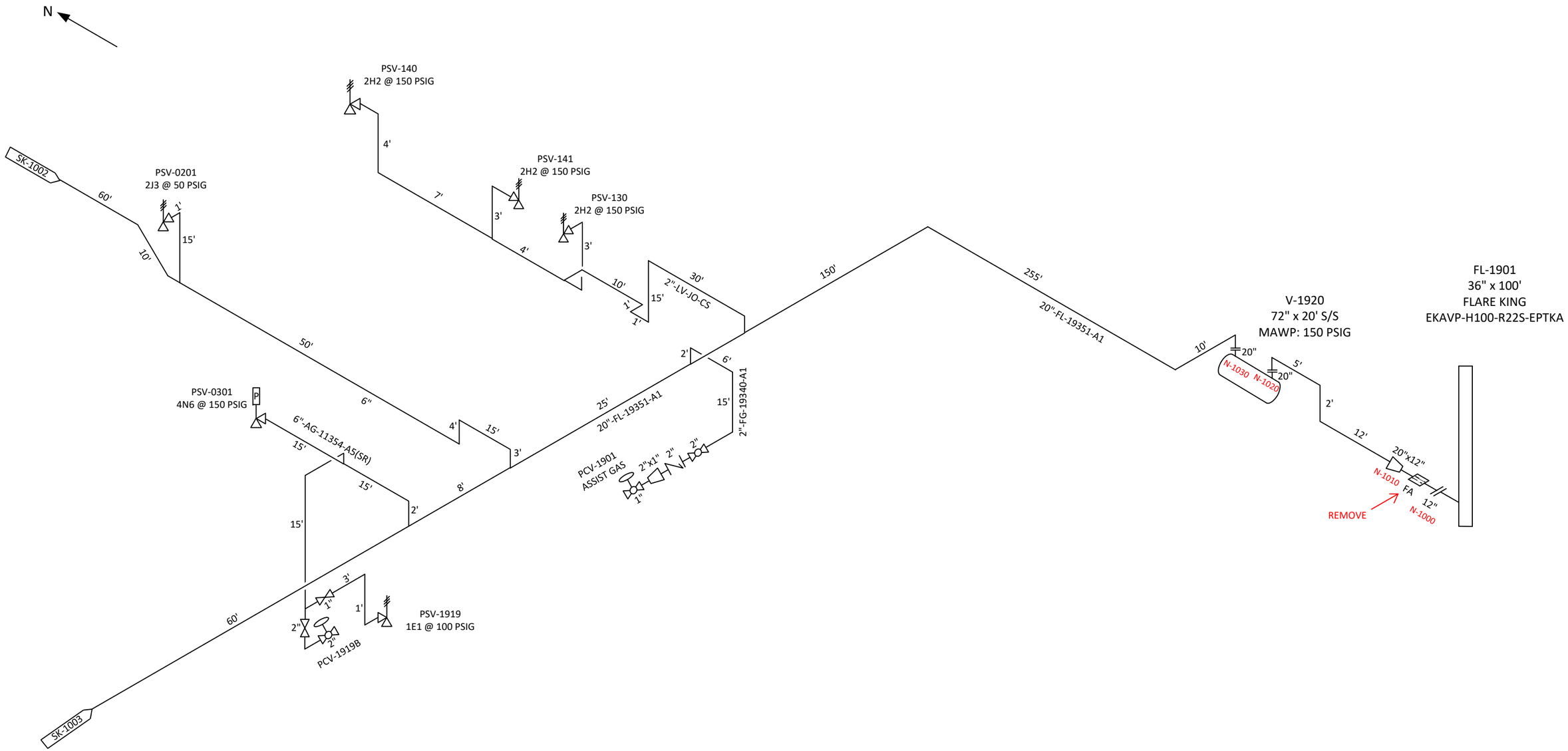
Knockout Drum Results

The knockout drum is capable of separating droplets greater than 463 microns based on the total flow of 26.6 MMSCFD and conditions of 3.1 psig and 352^{o} F. This is within the API STD 521 recommended range of 300 to 600 microns.

Flare Results

The exit velocity from the flare tip is 0.60 Mach and the maximum radiation at grade is 2,600 Btu/hr/ft^2 at approximately 147’ from the base of the flare stack. As the flare is located in a relatively remote location and the only requirement is for personnel to be able to escape the area, the radiation levels are acceptable.

APPENDIX A – Relief Header Network Drawing



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(NEGLIGIBLE LENGTH)

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March 2024

TARGA

ENG. RECORD		DATE
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SCALE		

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RELIEF HEADER

JOB NO. 23-1005

DRAWING NO. SK-1001 **Revision A** REV. A

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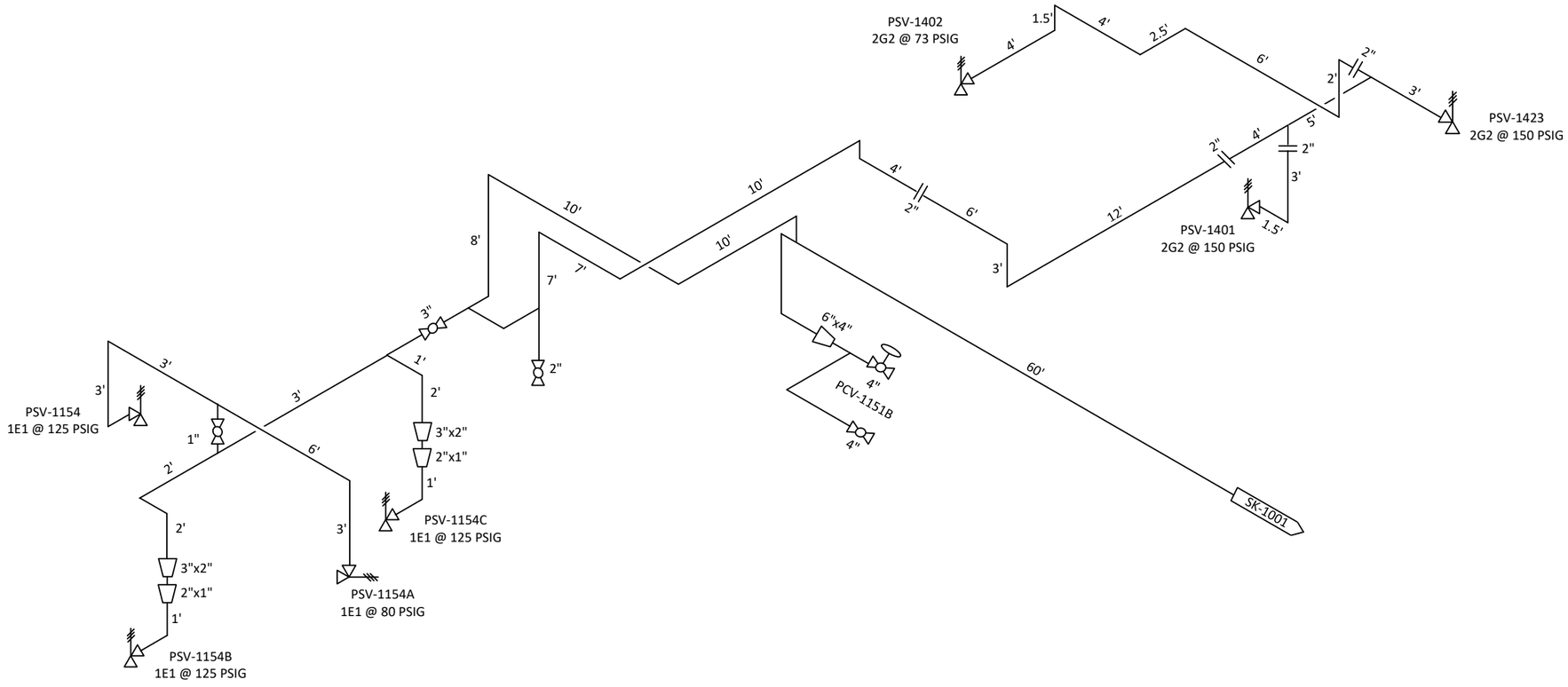

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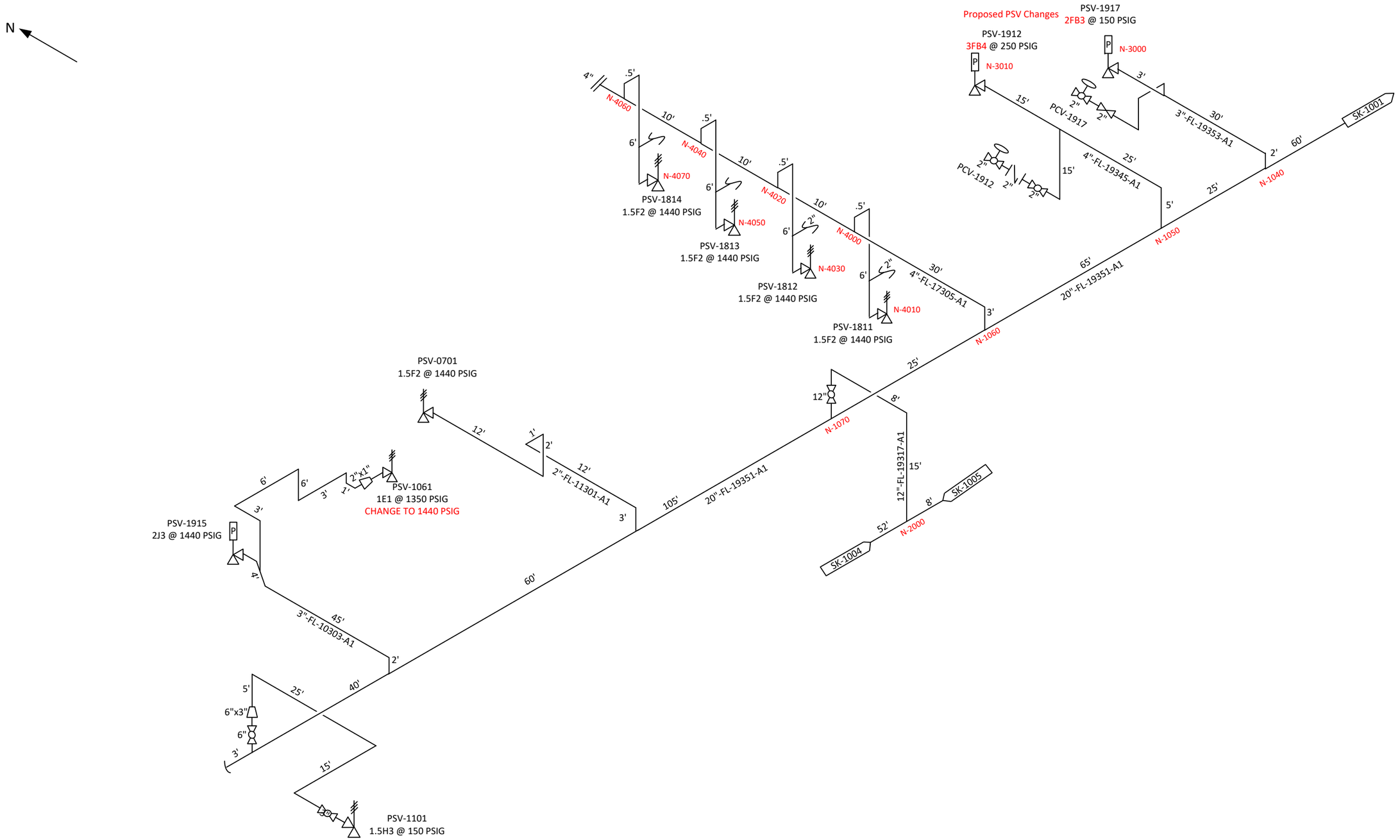
Revision A



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TARGA WELLS VALLEY COMPRESSOR STATION
RELIEF HEADER

JOB NO. 23-1005 **Revision A**

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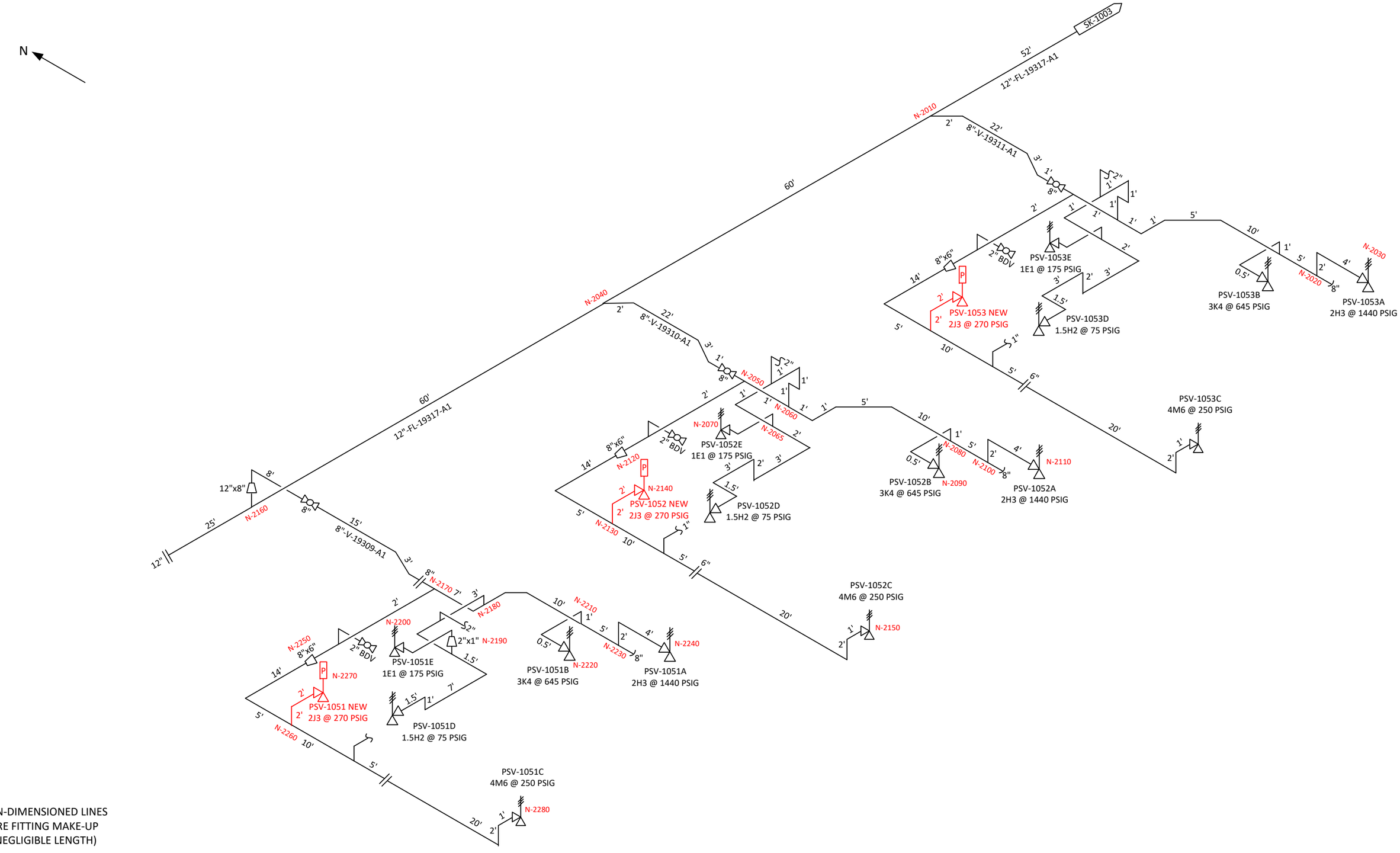

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TARGA WELLS VALLEY COMPRESSOR STATION
RELIEF HEADER

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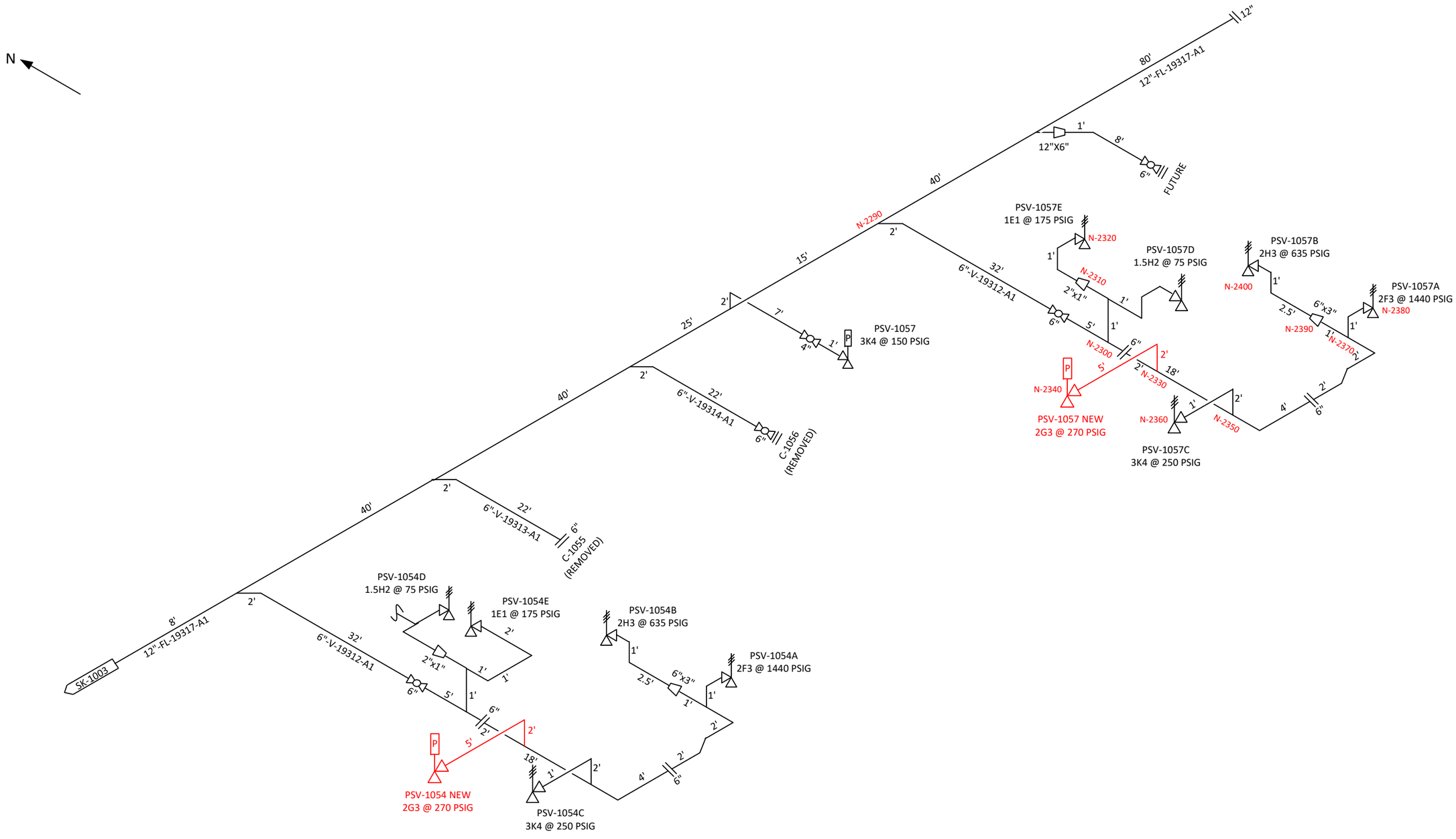

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TARGA WELLS VALLEY COMPRESSOR STATION
RELIEF HEADER

JOB NO. 23-1005

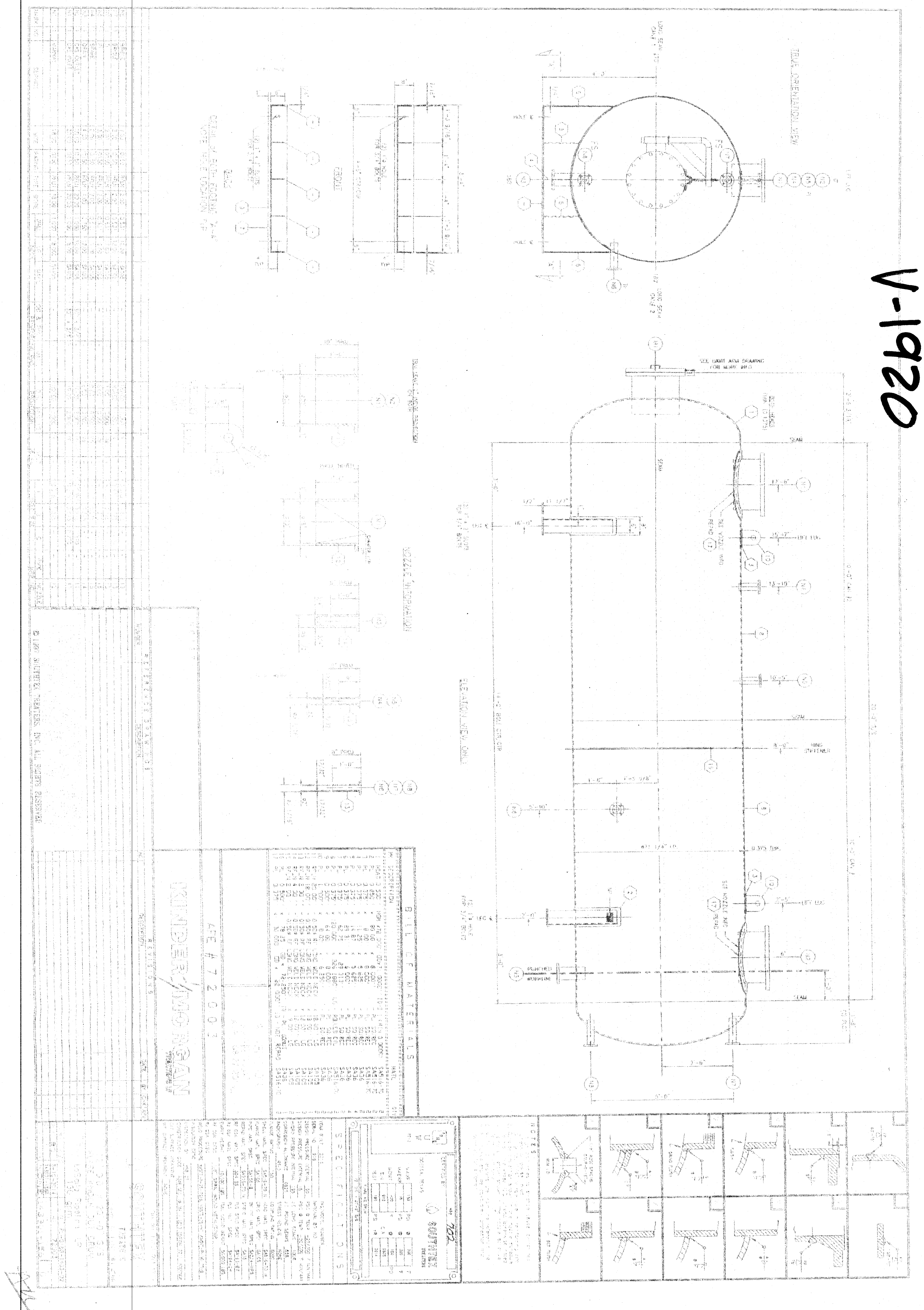
DRAWING NO. SK-1005

REV. A

Revision A

APPENDIX B – Knockout Drum (PV-111) and Flare (FL-1901)

HP Flare


V-1920

U-1920

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
(Alternate Form for Single Chamber, Completely Shop or Field Fabricated Vessels Only)
As Required by the Provisions of the ASME Boiler and Pressure Vessel Code Rules, Section VIII, Division 1

1. Manufactured and certified by SouthTex Treaters, Inc. 13405 HWY. 191 ODESSA TX 79765 USA
(Name and address of Manufacturer)

2. Manufactured for FRio LaSalle Pipeline, LP 18615 Tuscany Stone, Suite 300 San Antonio Texas 78258 USA
(Name and address of Purchaser)

3. Location of installation UNKNOWN
(Name and address)

4. Type Horizontal (Horizontal or vertical, tank) 916 (Manufacturer's serial number) - (CRN) 143901-156 (Drawing number) 702 (National Board number) 2014 (Year built)

5. ASME Code, Section VIII, Division 1 2013 Edition [Edition and Addenda, if applicable (date)] - (Code Case numbers) - [Special service per UG-120(d)]

6. Shell SA-516 70N (Material spec. number, grade) 0.375" (Nominal thickness) 0.0625" (Corr. allow.) 72" O.D. (Inner diameter) 20'-0" S/S [Length (overall)]

Body Flanges on Shells												
									Bolting			
No.	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Location	Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

7. Seams TYPE 1 [Long. (welded, dbl., sngl., lap, butt)] Full [R. T. (spot or full)] 100 (Eff., %) - (H. T. temp.) - (Time, hr) TYPE 1 [Girth (welded, dbl., sngl., lap, butt)] Spot [R. T. (spot or full)] 85 (Eff., %) 2 (No. of courses)

8. Heads: (a) Material SA-516 70N (Spec. no., grade) (b) Material SA-516 70N (Spec. no., grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side To Pressure (Convex or Concave)
(a)	ENDS	0.3125"	0.0625"	-	-	2:1	-	-	-	CONCAVE
(b)	-	-	-	-	-	-	-	-	-	-

Body Flanges on Heads												
									Bolting			
	Location	Type	ID	OD	Flange Thk	Min Hub Thk	Material	How Attached	Num & Size	Bolting Material	Washer (OD, ID, thk)	Washer Material
(a)	-	-	-	-	-	-	-	-	-	-	-	-
(b)	-	-	-	-	-	-	-	-	-	-	-	-

9. MAWP 150 (Internal) 15 (External) at max. temp. 300 (Internal) 300 (External)

Min. design metal temp. -20 at 150 Hydro., ~~pneu.~~, ~~or~~ ~~comb.~~ test pressure 195

Proof test -

10. Nozzles, inspection, and safety valve openings

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Type	Material		Nozzle Thickness		Reinforcement Material	Attachment Details		Location (Insp. Open.)
				Nozzle	Flange	Nom.	Corr.		Nozzle	Flange	
Manway	1	18"	RFLN	SA-105	-	1"	0.0625"	INHERENT	UW16.1c	-	HEAD
Inlet/Outlet	2	20"	RFLN	SA-105	-	1"	0.0625"	INHERENT	UW16.1c	-	SHELL
Drain	1	4"	RFLN	SA-105	-	0.750"	0.0625"	INHERENT	UW16.1c	-	SHELL
Bridle,TI,PI,Spare	5	2"	RFLN	SA-105	-	0.531"	0.0625"	INHERENT	UW16.1c	-	SHELL
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

11. Supports: Skirt NO (Yes or no) Lugs 2 (Number) Legs 2 (Number) Other - (Describe) Attached WELDED TO SHELL (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: ITEM #6. WAGNER PLATE WORKS, S/N 13-440-3B & 3C
(Name of part, item number. Manufacturer's name and identifying stamp)

IMPACT EXEMPT PER UCS-66. UG-125 PRV PROVIDED BY USER

U1A - Revision 4 - FP 2014.7.0

FORM U-2A MANUFACTURER'S PARTIAL DATA REPORT (ALTERNATIVE FORM
A Part of a Pressure Vessel Fabricated by One Manufacturer for Another Manufacturer
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by WAGNER PLATE WORKS, LLC, 4142 W. 49TH STREET TULSA, OKLAHOMA 74107
(Name and address of Manufacturer)

2. Manufactured for KINDER MORGAN / SOUTHTEX TREATERS 13405 HWY 1941 ODESSA, TX 76765
(Name and address of Purchaser)

3. Location of installation UNKNOWN
(Name and address)

4. Type: SHELL (Description of vessel part (shell, two-piece head, tube bundle)) | 13-440-3B & 3C (Mfg's serial No.) | NA (CRN)
(Nat'l. Bd. No.) | 13-440-3 (Drawing No.) | WPW (Drawing prepared by) | 2013 (Year built)

5. ASME Code, Section VIII, Div. 1 2010 - 2011 (Edition and Addenda (date)) | - (Code Case No.) | NA (Special Service per UG-120(c))

6. Shell (a) No. of course(s): 1 EACH (b) Overall length (ft & in.): 10' - 0"

Course(s)			Material	Thickness		Long. Joint (Cat. A)			Circum. Joint (Cat. A, B, & C)			Heat Treatment	
No	Diameter, in.	Length, ft & in.	Spec./Grade or Type	Nom.	Corr.	Type	Full, Spot, None	Eff.	Type	Full, Spot, None	Eff.	Temp.	Time
1	72" O.D.	10' - 0"	SA-516-70N	3/8"	-	1	FULL	100%	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-

7. Heads: (a) - (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp (b) - (Mat'l Spec. No., Grade or Type) H.T. - Time & Temp

	Location (Top, Bottom, Ends)	Thickness Min.	Thickness Corr.	Radius Crown	Radius Knuckle	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure Convex	Side to Pressure Concave	Category A Type	Category A Full, Spot, None	Category A Eff.
(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(b)	-	-	-	-	-	-	-	-	-	-	-	-	-	-

If removable, bolts used (describe other fastening) - (Mat'l Spec. No., Grade, Size, No.)

8. MAWP - (internal) - (external) psi at max. temp. - (internal) - (external) °F Min. design metal temp. - °F at - psi

9. Impact test NO (Indicate yes or no and the component(s) impact tested) at test temperature of - °F

10. Hydro., ~~pneu., pneumatic~~ test press. BY CUSTOMER Proof test -

11. Nozzles, inspection, and safety valve openings:

Purpose (Inlet, Outlet, Drain, etc.)	No.	Diameter or Size	Flange Type	Material Nozzle	Material Flange	Nozzle Thickness Nom.	Nozzle Thickness Corr.	Reinforcement Material	How Attached Nozzle	How Attached Flange	Location (Insp. Open.)
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

12. Supports: Skirt NO (Yes or No) Lugs - (No.) Legs - (No.) Others - (Describe) Attached - (Where and How)

13. Remarks WPW RETAINS RESPONSIBILITY FOR WORKMANSHIP AND MATERIAL ONLY. COLD FORMED. HAS NOT BEEN P.W.H.T. DESIGN IS THE RESPONSIBILITY OF THE CUSTOMER. WPS QUALIFIED A.W. & P.W.H.T. P.O. 6500037-0-STAT

CERTIFICATE OF SHOP/FIELD COMPLIANCE

We certify that the statements made in this report are correct and that all details of material, construction, and workmanship of this pressure vessel part conform to the ASME Code for Pressure Vessels, Section VIII, Division 1.

U Certificate of Authorization No. 32,396 Expires 02/27/2016

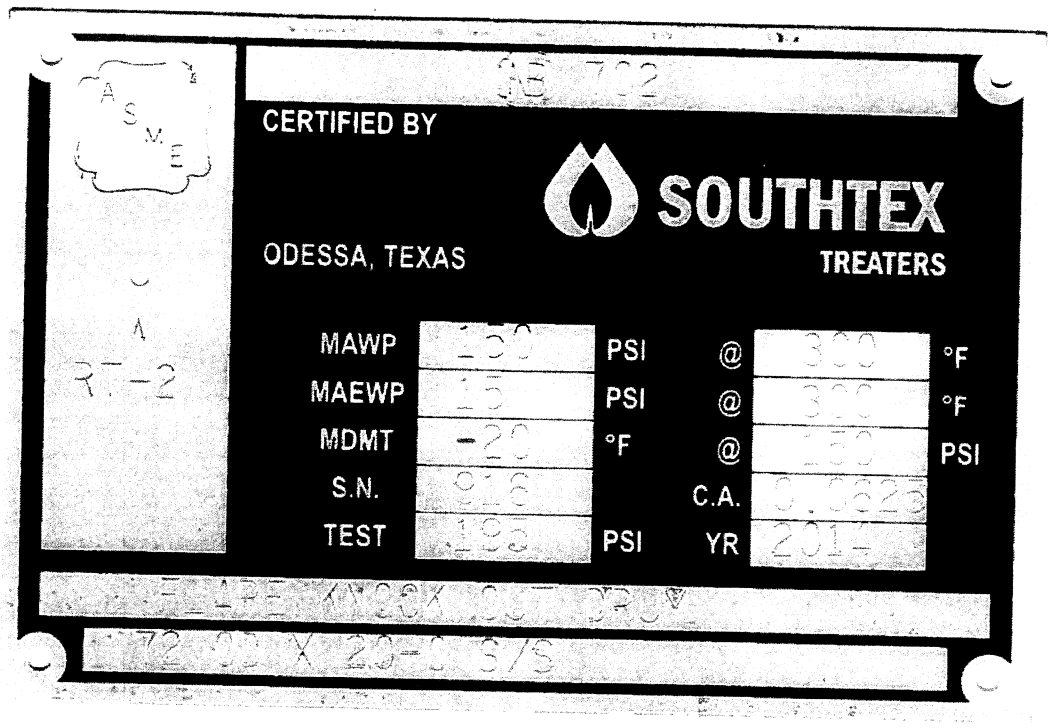
Date 08/30/2013 Name WAGNER PLATE WORKS, LLC (Manufacturer) Signed Stefanie Eastin (Representative)

CERTIFICATE OF SHOP/FIELD INSPECTION

I, the undersigned, holding a valid commission issued by The National Board of Boiler and Pressure Vessel Inspectors and the State or Province of OKLAHOMA and employed by HSB CT of HARTFORD, CT have inspected the pressure vessel part described in this Manufacturer's Data Report on 08/30/2013, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel part in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel part described in this Manufacturer's Data Report. Furthermore, neither the inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.

Date 08/30/2013 Signed (Authorized Inspector) Commissions NB13413A OK 962 (Nat'l Board incl. endorsement, State, Province and No.)

CSI
Form 1042 Rev. 2


CERTIFIED BY
SOUTHTEX
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MAWP
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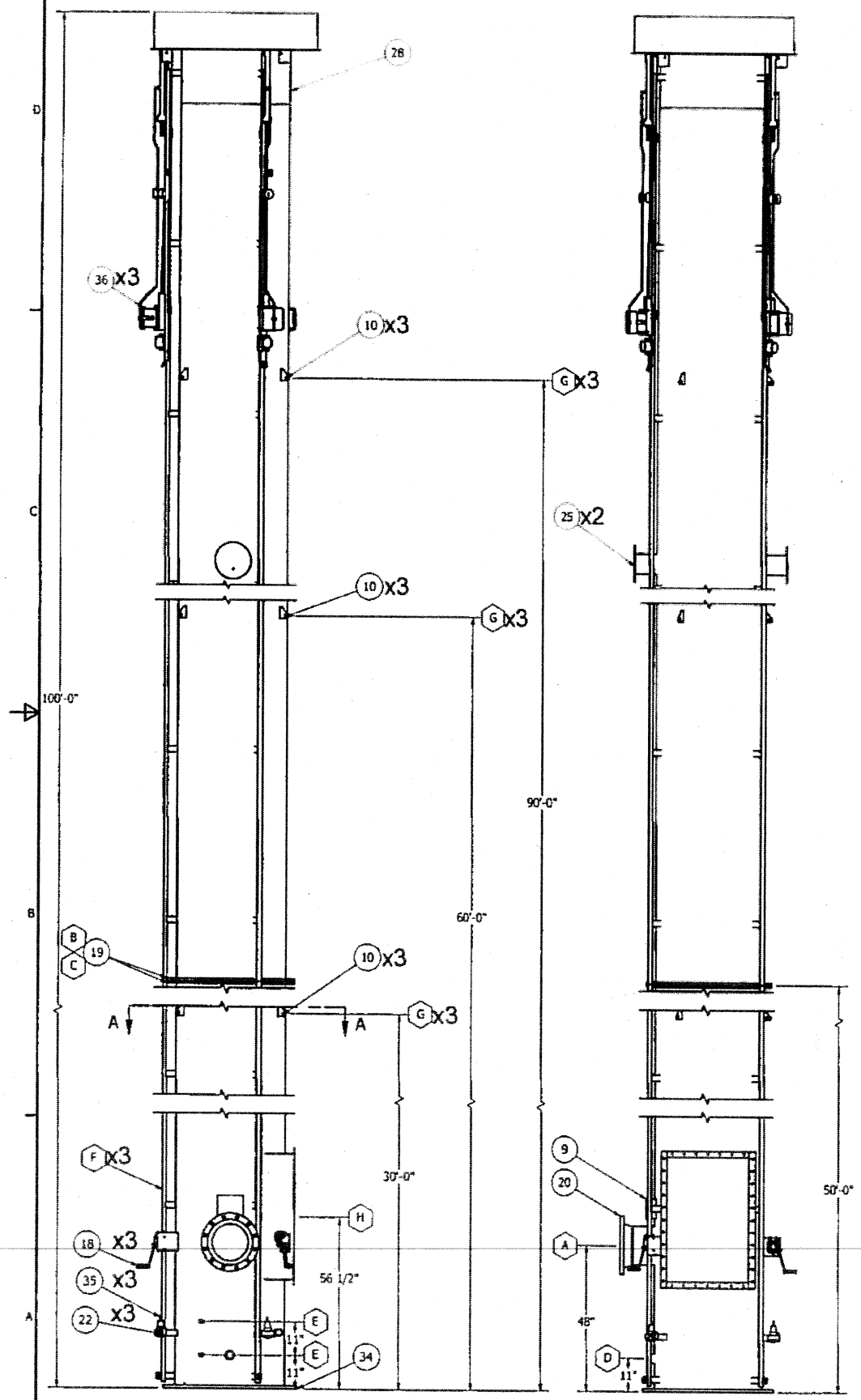
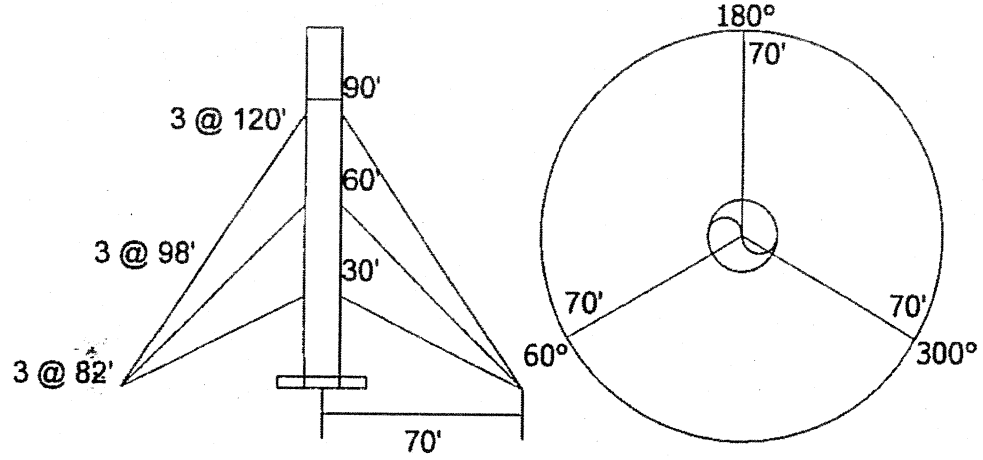
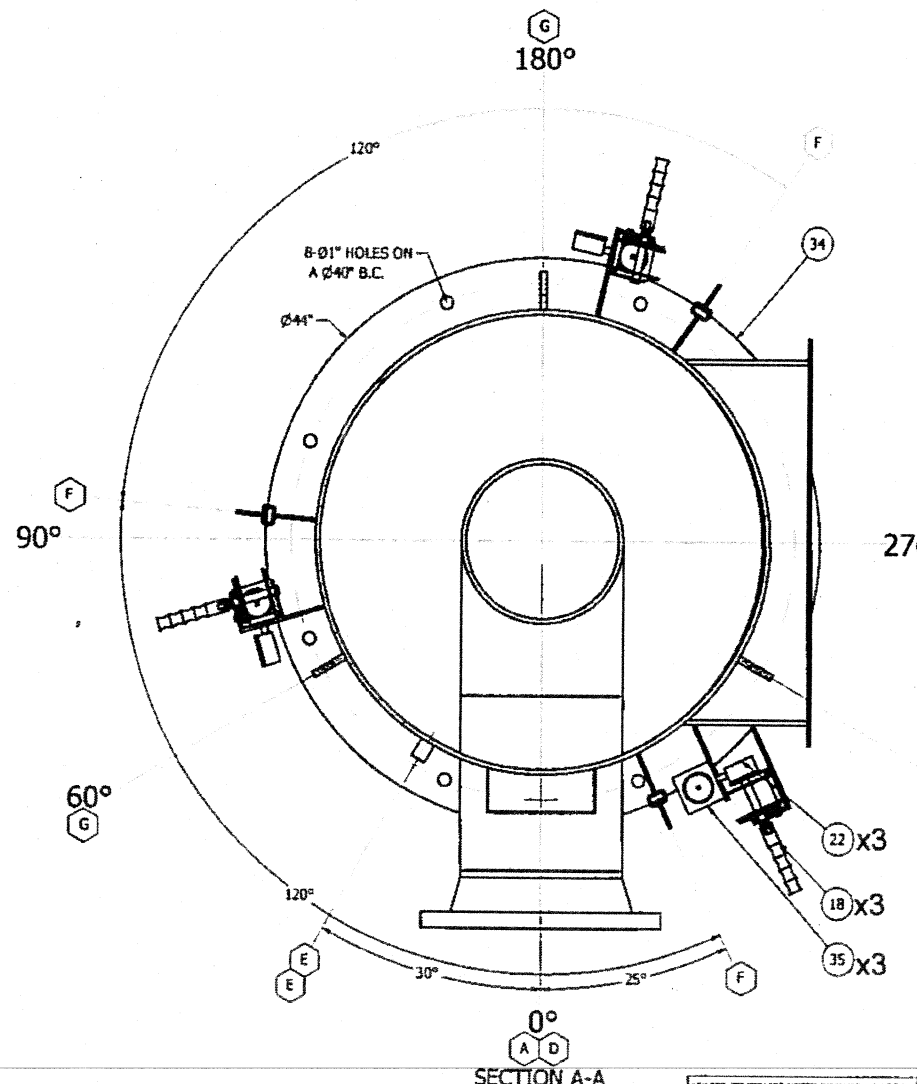






BILL of MATERIALS

ITEM	QTY	WEIGHT (lbs)	STOCK NUMBER	DESCRIPTION	MATERIAL
1	1	147.9	BAFF5636	PLATE: 56" OD x 36 1/8" ID x 3/8" THK	SA 36
2	8	6.4	BARF1957	BAR, FLAT: 4" X 1/2" THK x 11 1/4" LG	A-36
3	12.04'	20.0	BARF2014	1/4" x 2" FLAT BAR	A-36
4	66	.5	BARF2014	BAR, FLAT: 2" X 1/4" THK x 3 3/8" LG	A-36
5	8	2.8	BARF2038	BAR, FLAT: 2" X 1/4" THK x 20" LG	A-36
6	36	.3	BARF2038S	BAR, FLAT: 2" x 3/8" x 1 1/2", 304SS	304 SS
7	11.38'	145.2	BARF8653	3/8" x 10" FLAT BAR	A-36
8	1	147.9	BONT5412	PLATE: 54" OD x 12" TALL x 1/4" THK, ROLLED&WELDED	304 SS
9	1	3.4	BRKT0001	FLARE NAME PLATE BRACKET	A-36
10	9	1.0	BRKTF100	GUY WIRE LUG	A-36
11	3	3.0	BRKTF110	WINCH BRACKET	A-36
12	3	.2	BRKTF120	TAG LINE BRACKET	A-36
13	3	.9	BRKTF130	REGULATOR BRACKET	A-36
14	3	2.4	BRKTF200	PULLEY BOX	SA-36
15	15	.3	BRKTF210	TRACK ALIGNMENT PIN	A-36
16	1	77.9	ELL4585	12" STD SR 90	SA-234WPB
17	3	4.5	ELL8165	ELBOW: 4", SCH 10, LR, 90 DEG	304 SS
18	3	2.9	FLMSC320	WINCH, 2000#	-
19	2	76.0	FLNG4234	PLATE: 42" OD x 36 1/8" ID x 3/4" THK , 8- 3/4" HOLES	SA-36
20	3	84.5	FLNG4516	FLANGE: 12", 150#, RFWN	SA-105
21	12	3.3	GASA2111	PIPE: 2" x SCH STD x 11 3/4" LG, 1" SLOT	304 SS
22	3	1.8	GAUG4488	GAUGE PRESS 0-30lbs	-
23	1	2.2	HARDWARE	COUPLING, HALF: 2", 3000#	SA-234 WPB
24	2	.3	HARDWARE	COUPLING: 1/2", 3000#	SA-234 WPB
25	2	22.1	LLUG002	CERTIFIED LIFTING LUGS	A-53
26	1	7126.7	PIPE1708	PIPE: 36" x Sch STD x 598 3/4" LG	A-53
27	1	6780.0	PIPE1708	PIPE: 36" x Sch STD x 569 5/8" LG	A-53
28	1	294.0	PIPE1708S	PIPE: 36" x Sch STD x 24" LG, 304SS	304 SS
29	1	20.2	PIPE4393	PIPE: 12" x Sch STD x 13 1/2" LG	A-53
30	1	2214.1	PIPE4393	PIPE: 12" x Sch STD x 535 1/2" LG	A-53
31	1	2296.8	PIPE4393	PIPE: 12" x Sch STD x 555 1/2" LG	A-53
32	1	102.1	PIPE4393S	PIPE: 12" x Sch STD x 24 LG, 304SS	304 SS
33	1	103.8	PLAT3538	PLATE: 35 1/4" OD x 3/8" THK	A-36
34	1	429.4	PLAT4410	PLATE: 44" DIA x 1" THK x 8-1" HOLES ON 40" BC	A-36
35	3	1.6	REGU2000	REGULATOR, 300 BAF	-
36	3	38.8	RPLT2012	RETRACTABLE PILOT TC SLED w/ 70 PILOT	-
37	3	124.4	TBGR1510	TUBING, RECT: 1 1/2" x 1" x 1/8" x 586 11/16" LG	SA-36
38	3	126.8	TBGR1510	TUBING, RECT: 1 1/2" x 1" x 1/8" x 598" LG	SA-36

APPROVALS:
ENGINEERING:
PROD COORDINATOR:
PROD SUPER:
QUALITY CONTROL:

WEIGHT: 21298 lbmass

ITEMS NOT SHOWN

ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL
1	1	BLR40000	60hp, ACF 36 BLOWER	-
2	36	CLMP0102	CABLE CLAMP 1/2"	-
3	18	CLMP0316	CABLE CLAMP 3/16"	-
4	3	CTLAC700	BOX, CONTROL, 110V w/R THERMO	-
5	1	FADT1215	12" DETONATION ARRESTOR	-
6	3	FLMSC100	SWIVEL EYE BLOCK	-
7	2	GSKT1215	12" FLANGE GASKET RFWN	304 SS
8	6	HOSE5050	50' STAINLESS STEEL FUEL HOSE	304 SS
9	1	NMPL1000	NGSG NAME PLATE (CERTIFIED)	-
10	18	THMB0102	CABLE THIMBLE 1/2"	-
11	9	THMB0316	CABLE THIMBLE 3/16"	-
12	660'	WIRCD163	SO WIRE 16-3	-
13	900'	WIRGV102	GALVANIZED STEEL CABLE 1/2"	-
14	858'	WIRSS316	3/16" SS CABLE	304 SS

SCHEDULE of OPENINGS

ITEM	DESCRIPTION	TYPE	RATING	SIZE	ORIENTATION
A	INLET FLANGE	RFWN	150#	12"	0°
B	STACK FLANGE	FFWN	-	36"	-
C	TIP FLANGE	FFWN	-	36"	-
D	DRAIN	NPT	3000#	2"	0°
E	SITE GLASS	NPT	3000#	1/2"	30°
F	TRACK	PILOT	THERMO	RETRACT	95° / 215° / 335°
G	GUY WIRE	-	-	-	60° / 180° / 300°
H	BLOWER	-	60HP	ACF36	270°
J	LIFTING LUGS	CERTIFIED	-	-	90°/270°
K	GAS STACK FLANGE (NOT SHOWN)	RFWN	150#	12"	-

UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES AND TOLERANCES

LENGTH	ANGLE	DIMS
± 1/8"	±1	<48"
± 1/4"	±1	>48'
± 1/4" / 25'		OVERALL
PSX-700		3-7 mils

DO NOT SCALE PRINT

REVISION HISTORY

REV	DESCRIPTION	ENG APPROVAL DATE	AUTHOR
0	INITIAL DESIGN		Margarito Vasquez

NGSG
NATURAL GAS SERVICES GROUP, INC.
12301 W. Co. Rd. 125
Odessa, Texas 79765
TEL: (432) 262-2700
FAX: (432) 262-2701
www.ngsgi.com AMEX: NGS

CUSTOMER:
CUSTOMER JOB #: FL020978
DRAFTSMAN: Margarito Vasquez | DATE DRAWN: 7/1/2014

100' ANNULAR AIR ASSISTED TIP FLARE

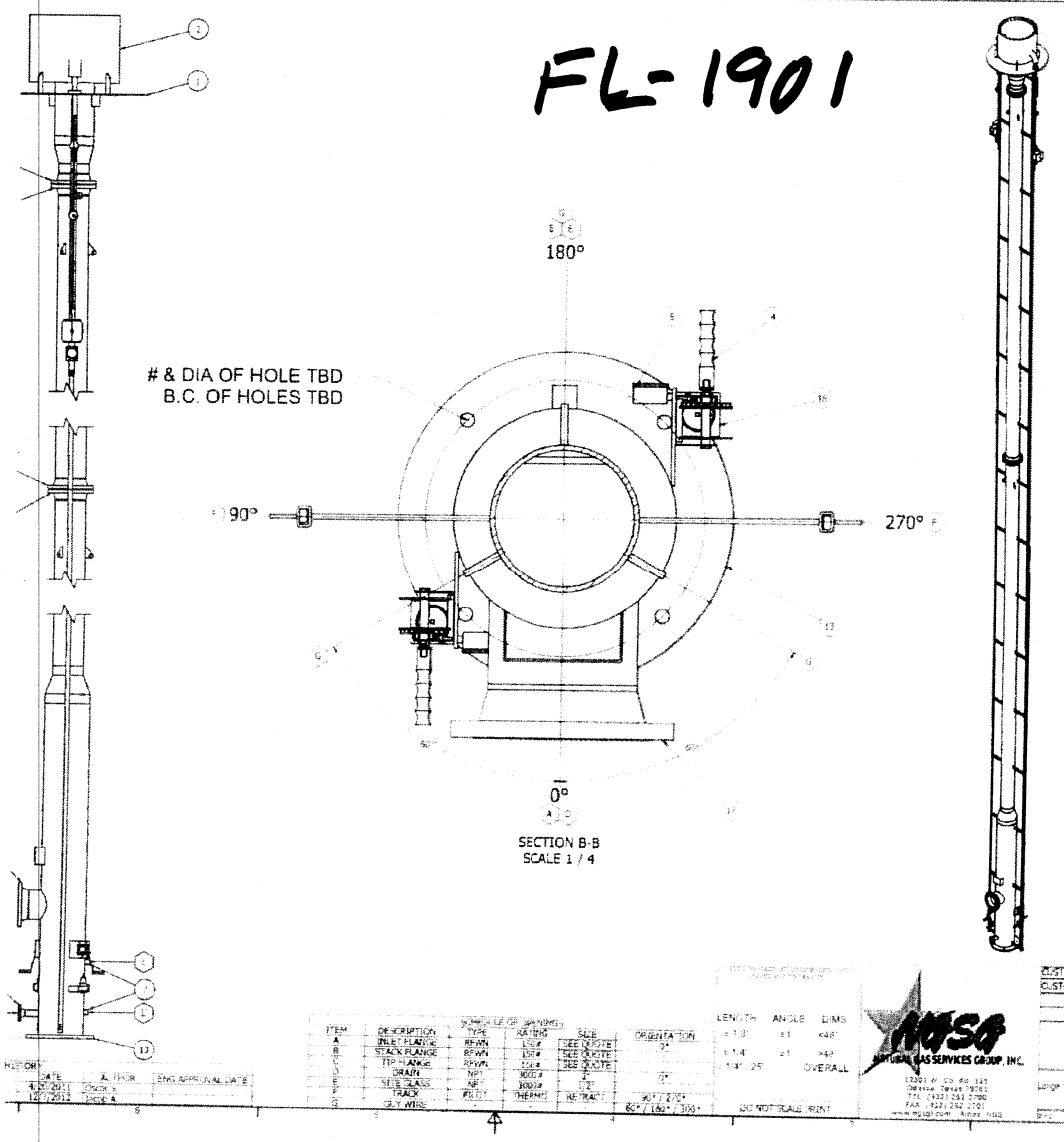
JOB NO.	SIZE	DRAWING NO.	REV
	D	FL020978	0

SCALE: | FILE NO: FL020978.idw | SHEET 1 OF 5

Revision A

March 2024

FL-1901



SECTION B-B
SCALE 1 / 4

ITEM	DESCRIPTION
1	HEAT BAFFLE
2	WIND BONNET
3	GUY WIRE LUG
4	WINCH, 2000 #
5	DRAIN CONNECTION
6	GAUGE PRESS 0-300lbs
7	SIGHT GLASS PORTS
8	PIPE SIZE TBD
9	TIP PIPE, SEE QUOTE
10	PIPE SIZE TBD
11	PIPE SIZE TBD
12	PIPE SIZE TBD
13	BASE PLATE, SIZE AND HOLES TBD
14	REDUCER AS REQ
15	REDUCER AS REQ
16	REGULATOR, 300 BAR
17	RETRACTABLE PILOT TC SLED w/ 70' PILOT
18	PILOT TRACK

ITEM	DESCRIPTION	SCHEDULE OF OPENINGS TYPE	RATING	SIZE	ORIENTATION
A	INLET FLANGE	RFWN	150#	SEE QUOTE	0°
B	STACK FLANGE	RFWN	150#	SEE QUOTE	
C	TIP FLANGE	RFWN	150#	SEE QUOTE	
D	DRAIN	NPT	3000 #	2"	
E	SITE GLASS	NF	3000#	12"	0°
F	TRACK	PILOT	THERMIT	RETRACT	90° / 270°
G	GUY WIRE				65° / 180° / 300°

LENGTH	ANGLE	DIMS
1 1/2"	61°	<48"
1 1/4"	21°	>48"
1/4" 25°		OVERALL

DO NOT SCALE PRINT

MGS
NATURAL GAS SERVICES GROUP, INC.
12301 W. Co. Rd 127
Odessa, Texas 79763
TEL (432) 563-3700
FAX (432) 563-3701
www.ngsgroup.com

CUSTOMER	YKKOT
CUSTOMER JOB #	FL0210xx
DRAFTSMAN	John Gale
DATE DRAWN	10/18/2012

NOTICE: THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND IT SHALL NOT BE USED, REPRODUCED OR DISCLOSED TO OTHERS IN WHOLE OR IN PART WITHOUT PRIOR WRITTEN APPROVAL FROM NATURAL GAS SERVICES GROUP

LARGE UTILITY TIP FLARE

SIZE	DRAWING NO.
D	FKUT-HXX-RXXS-EXXXX

Large Utility Tip Flare

Large Utility Flare.drv

SHEET 1 OF 1

DATE	A. FOR	ENG APPROVAL DATE
4/30/2013	ISSUE A	
12/7/2012	ISSUE A	

FLARE KING, INC.

Customer: Kinder Morgan
Job: PRV
Date: 5/30/2014 10:42

DATA ENTRY SECTION:

Relief Fluid Data:

	Mol %
H_2S	0.2504
N_2	0.1869
O_2	0.0000
H_2	0.0000
H_2O	0.0313
CO_2	1.0562
Methane - C_1	76.8375
Ethane - C_2	12.7360
Propane - C_3	5.3682
isoButane - iC_4	0.7464
neoButane - nC_4	1.5516
isoPentane - iC_5	0.3940
neoPentane - nC_5	0.4332
Hexane - C_6	0.2960
Heptane - C_7	0.0989
Octane - C_8	0.0134
Ethylene	0.0000
Propylene	0.0000
Benzene	0.0000
Toluene	0.0000
Ethylbenzene	0.0000
m-Xylene	0.0000
Total:	100.0

Duty(mmscfd):	28.400
Temp. °F	-8
Inlet Pres psi	5
Pilot	X
Sparker	
Retrackable	X
Guyed	X
Free Standing	
Solar	
Enclosed	

Gas Assist Target LHV: btu/scf
Assist Air: scfm

Radiation Criteria:

Max Rad@Base:	1200	btu/hr.ft²
Emissivity:	0.222	
Atm. Temp:	70	°F
Relative Humidity:	50	%
Wind velocity:	29.3	fps
Flare Tip ϕ:	14	in
Flare Height(oah)	100	ft
Tip Press.	14.4	psia
Altitude	500	ft
Rad Factor:		

Dist, horiz.(ft)
0.0
15.0
30.0
50.0
75.0
100.0
150.0
200.0

CALCULATED DATA:

Relief Fluid Data:

Total Flow	28.400	mmscfd
MW/SG:	21.43	0.740
Density:	0.0565	lb/scf
LHV:	1148.9	btu/scf
LHV:	20321.1	btu/lb
k (Cp/Cv)	1.271	
Z Compressibility	0.9948	
Viscosity	0.010	cp
C:H ratio	0.273	
Flow:	66827.1	lb/hr
Duty:	1358.00	mmBTU/hr
Flow:	291.261	acfs
Air Req'd:	236248.1	scfm
Air Req'd(ft^3air / ft^3gas):	11.98	

Flare Data:

Calc'd Emissivity:	0.222	
Tip ΔP:	22.65	in H_2O
Tip Velocity:	293.0	fps
Sonic Velocity:	1154.5	fps
Mach Number:	0.25	
Flame Length (less assist air):	137.4	ft
Min. Flare Height:	96.6	ft @base
H2S Flare Height:	#VALUE!	ft
# Pilots Req'd	**2**	ea
U_{wind}/U_{exit}	0.10	
Δx:	106.3	ft
Δy:	61.0	ft
Sound level	124.9	db
Vmax=	566.5	ft/s
Air Assit Vmax=	126.5	ft/s

Radiation(btu/hr.ft²)	Rad Factor
976.5	0.81
1051.2	0.81
1108.0	0.81
1143.4	0.81
1112.0	0.81
1009.7	0.81
727.8	0.80
492.2	0.79

Rev A

FLARE KING, INC.

TECHNICAL DATA

DESCRIPTION: 14" UTILITY TIP WITH RETRACKTABLE PILOT ON 100' OAH GUYED STACK

CUSTOMER: Kinder Morgan

DESIGN PARAMETERS:

FLOW RATE:	28.400 mmscfd
TEMPERATURE:	-8 °F
MOLECULAR WEIGHT:	21.43 lb/lb-mol
TIP PRESSURE DROP:	0.82 psig
EXIT VELOCITY:	293.0 fps
MACH NO.:	0.25

UTILITIES:

PURGE GAS (w/seal):	117.7 cfh
PURGE GAS (w/o seal):	N/A
ASSIST GAS:	N/A
PILOT GAS:	8-12 cfh @ 10 psig

ELECTRIC:

IGNITION:	3 amps @ 120V-1Ph-60Hz
CONTROLS:	3 amps @ 120V-1Ph-60Hz
BLOWER:	N/A

ENVIRONMENTAL:

RADIATION ON GRADE @DESIGN FLOW RATE, Btu/SF/Hr:

	(@Distance from base, ft)				Wind@	20.0	mph.
@ BASE	15	30	50	75	100	150	200
976.5	1051.2	1108.0	1143.4	1112.0	1009.7	727.8	492.2

NOTE: Radiation does not include solar radiation (approx. 250 btu/hr).

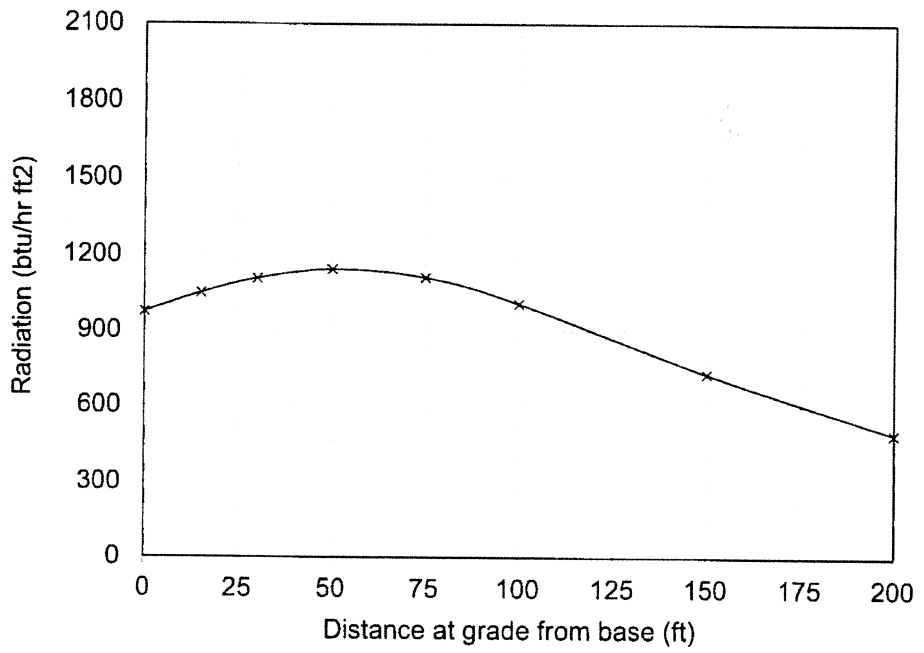
DESTRUCTION EFFICIENCY: 98%

FLARE KING, INC.

Customer: Kinder Morgan
Job: PRV

Wind Velocity: 20.0 mph

Radiation vs. Distance



NOTE: Radiation does not include solar radiation (approx. 250 btu/hr).

Recommended Design Total Radiation (from API RP-521)

Permissible Design Level (K) (BTU/hr ft^2)	Conditions
5000	Heat intensity on structures and in areas where operators are not likely to be performing duties and where shelter from radiant heat is available (for example, behind equipment).
3000	Value of K at design flare release at any location to which people have access (for example, at grade below the flare or a service platform of a nearby tower); exposure should be limited to a few seconds, sufficient for escape only.
2000	Heat intensity in areas where emergency actions lasting up to 1 minute may be required by personnel without shielding but with appropriate clothing.
1500	Heat intensity in areas where emergency actions lasting several minutes may be required by personnel without shielding but with appropriate clothing.
500	Value of K at any location where personnel with appropriate clothing may be continuously exposed.

APPENDIX C – Blocked Facility Outlet Scenario Details

Hydraulic Detailed Results

Knockout Drum Detailed Results

Flare Detailed Sizing Results

Relief Load Calculations

Targa Resources LLC
Valley Wells Compressor Station
Blocked Facility Outlet - 3 of 5 Compressor Running (C-1051, 1052 & 1057)

Client:	Targa Resources LLC		Increments/Seg.	5	
Project:	Valley Wells Compressor Station		P Atm	14.7	psia
Project Number:	23-1005		Exit Pressure	2	psig
Date:	Mar-24		Roughness	0.00015	feet
Created by:	Rob Kreder		Friction dP Only	FALSE	

Input Data						Calculated Values						Inlet Conditions				Exit Conditions				Results				
Description	Segment	Start Node	End Node	Pipe NPS	Pipe Sch	Pipe ID (inches)	Equivalent Length (ft)	Segment Flow (lb/hr)	Segment Flow (MMSCFD)	Moody f	Fluid MW	P_1 (psig)	T_1 (F)	K_1	ρ_1 (lb/ft^3)	P_2 (psig)	T_2 (F)	K_2	Z_2	Segment ΔP (psi)	Max. Velocity (ft/sec)	Sonic Velocity (ft/sec)	Segment Max. Mach Number	Choke P at Segment Exit (psig)
Reducer To Flare Base	S-1005	N-1010	N-1000	12"	STD	12.000	2.0	189,329	79.14	0.013	21.79	5.2	194.4	1.206	0.062	2.0	194.2	1.206	0.052	3.2	1287.7	1341.9	0.96	1.3
KO Drum to Reducer	S-1015	N-1020	N-1010	20"	20	19.250	86.4	189,329	79.14	0.012	21.79	6.1	194.4	1.206	0.065	5.2	194.4	1.206	0.062	0.9	419.7	1342.1	0.31	-8.5
KO Drum	S-1025	N-1030	N-1020	20"	20	19.250	66.8	189,329	79.14	0.012	21.79	6.8	194.5	1.206	0.067	6.1	194.4	1.206	0.065	0.6	400.3	1342.1	0.30	-8.5
V-1917 Tie In to KO Drum	S-1035	N-1040	N-1030	20"	20	19.250	575.4	189,329	79.14	0.012	21.79	11.5	194.7	1.206	0.082	6.8	194.5	1.206	0.067	4.7	388.4	1342.2	0.29	-8.5
V-1912 to V-1917 Tie In	S-1045	N-1050	N-1040	20"	20	19.250	25.0	189,329	79.14	0.012	21.79	11.7	194.7	1.206	0.082	11.5	194.7	1.206	0.082	0.2	317.3	1342.4	0.24	-8.5
Sulfatreat to V-1912 Tie In	S-1055	N-1060	N-1050	20"	20	19.250	69.8	189,329	79.14	0.012	21.79	12.2	194.8	1.206	0.084	11.7	194.7	1.206	0.082	0.5	317.3	1342.4	0.24	-8.5
Compressor Sub to Sulfatreat Tie In	S-1065	N-1070	N-1060	20"	20	19.250	25.0	189,329	79.14	0.012	21.79	12.4	194.8	1.206	0.084	12.2	194.8	1.206	0.084	0.2	309.8	1342.5	0.23	-8.5
Common Compressor Subheader @1	S-1075	N-2000	N-1070	12"	STD	12.000	114.0	189,329	79.14	0.013	21.79	22.8	195.4	1.206	0.117	12.4	194.8	1.206	0.084	10.4	797.2	1342.5	0.59	1.3
West Compressor Subheader #1	S-2005	N-2010	N-2000	12"	STD	12.000	112.0	118,157	49.39	0.013	21.79	25.3	194.9	1.206	0.125	22.8	194.7	1.206	0.117	2.5	357.2	1342.4	0.27	-4.7
West Compressor Subheader #2	S-2035	N-2040	N-2010	12"	STD	12.000	80.0	118,157	49.39	0.013	21.79	27.0	195.0	1.206	0.130	25.3	194.9	1.206	0.125	1.7	334.3	1342.6	0.25	-4.7
C-1052 Subheader #1	S-2045	N-2050	N-2040	8"	40	7.981	80.5	46,985	19.64	0.014	21.79	29.1	192.5	1.206	0.137	27.0	192.4	1.206	0.131	2.1	286.8	1340.0	0.21	-5.7
C-1052 Subheader #2	S-2055	N-2060	N-2050	8"	40	7.981	26.9	46,985	19.64	0.014	21.79	29.8	192.6	1.206	0.140	29.1	192.5	1.206	0.137	0.7	274.2	1340.1	0.20	-5.7
C-1052 Subheader #3	S-2075	N-2080	N-2060	8"	40	7.981	37.0	46,985	19.64	0.014	21.79	30.8	192.6	1.206	0.142	29.8	192.6	1.206	0.140	0.9	268.3	1340.2	0.20	-5.8
C-1052 Subheader #4	S-2095	N-2100	N-2080	8"	40	7.981	18.3	46,985	19.64	0.014	21.79	31.2	192.6	1.206	0.144	30.8	192.6	1.206	0.142	0.5	264.6	1340.2	0.20	-5.8
PSV-1052A to Subheader	**S-2105**	**N-2110**	**N-2100**	**3"**	**40**	**3.068**	**9.6**	**46,985**	**19.64**	**0.017**	**21.79**	**93.7**	**196.2**	**1.206**	**0.341**	**45.8**	**193.5**	**1.206**	**0.190**	**47.8**	**1340.2**	**1340.2**	**1.00**	**45.8**
West Compressor Subheader #2	S-2155	N-2160	N-2040	12"	STD	12.000	80.0	71,172	29.75	0.013	21.79	27.6	196.7	1.206	0.132	27.0	196.7	1.206	0.130	0.6	193.6	1344.4	0.14	-8.7
C-1051 Subheader #1	S-2165	N-2170	N-2160	8"	40	7.981	87.9	71,172	29.75	0.014	21.79	33.0	197.0	1.206	0.148	27.6	196.7	1.206	0.132	5.3	431.1	1344.4	0.32	-1.1
C-1051 Subheader #2	S-2175	N-2180	N-2170	8"	40	7.981	40.3	71,172	29.75	0.014	21.79	35.2	197.1	1.206	0.155	33.0	197.0	1.206	0.148	2.2	384.5	1344.7	0.29	-1.1
C-1051 Subheader #3	S-2205	N-2210	N-2180	8"	40	7.981	20.6	71,172	29.75	0.014	21.79	36.3	197.2	1.206	0.159	35.2	197.1	1.206	0.155	1.1	367.1	1344.8	0.27	-1.1
C-1051 Subheader #4	S-2225	N-2230	N-2210	8"	40	7.981	18.3	71,172	29.75	0.014	21.79	37.2	197.2	1.205	0.162	36.3	197.2	1.206	0.159	0.9	357.9	1344.9	0.27	-1.1
PSV-1051A to Subheader	**S-2235**	**N-2240**	**N-2230**	**3"**	**40**	**3.068**	**9.6**	**46,985**	**19.64**	**0.017**	**21.79**	**93.7**	**196.2**	**1.206**	**0.341**	**45.8**	**193.5**	**1.206**	**0.190**	**47.9**	**1340.6**	**1340.6**	**1.00**	**45.8**
East Compressor Subheader	S-2215	N-2220	N-2000	12"	STD	12.000	208.0	71,172	29.75	0.013	21.79	24.4	196.5	1.206	0.122	22.8	196.4	1.206	0.117	1.7	215.1	1344.1	0.16	-8.7
C-1057 Subheader #1	S-2225	N-2230	N-2220	6"	40	6.065	46.6	71,172	29.75	0.015	21.79	39.1	197.3	1.205	0.168	24.4	196.5	1.206	0.122	14.7	807.7	1344.2	0.60	8.9
C-1057 Subheader #2	S-2245	N-2250	N-2230	6"	40	6.065	18.0	24,187	10.11	0.015	21.79	37.7	205.5	1.204	0.161	37.2	205.4	1.204	0.160	0.4	209.3	1352.2	0.15	-6.6
C-1057 Subheader #3	S-2265	N-2270	N-2250	6"	40	6.065	40.3	24,187	10.11	0.015	21.79	38.6	205.5	1.204	0.164	37.7	205.5	1.204	0.161	0.9	208.0	1352.3	0.15	-6.6
PSV-1057A to Subheader	**S-2275**	**N-2280**	**N-2270**	**3"**	**40**	**3.068**	**4.6**	**24,187**	**10.11**	**0.017**	**21.79**	**44.1**	**205.8**	**1.204**	**0.181**	**38.6**	**205.5**	**1.204**	**0.164**	**5.5**	**798.0**	**1352.3**	**0.59**	**16.8**

Targa Resources LLC
Valley Wells Compressor Station
Blocked Facility Outlet - 3 of 5 Compressor Running (C-1051, 1052 & 1057)

Client:	Targa Resources LLC
Project:	Valley Wells Compressor Station
Project Number:	23-1005
Date:	Mar-24
Created by:	Rob Kreder

Segment Data

Description	Segment	Start Node	End Node	Pipe NPS	Pipe Sch	Pipe ID (inches)	Moody F	Pipe Length (ft)	# 90 Elbows	Eq. Length 90 Elbows	# 45 Elbows	Eq. Length 45 Elbows	Entrances	Eq. Length Entrances	Tee Through	Eq. Length Tee Through	Tee Branch	Eq. Length Tee Branch	Ball Valve	Eq. Length Ball Valve	Equivalent Length (ft)
Reducer To Flare Base	S-1005	N-1010	N-1000	12"	STD	12.000	0.013	2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2.0
KO Drum to Reducer	S-1015	N-1020	N-1010	20"	20	19.250	0.012	19	3	67.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	86.4
KO Drum	S-1025	N-1030	N-1020	20"	20	19.250	0.012	0	0	0.0	0	0.0	1	66.8	0	0.0	0	0.0	0	0.0	66.8
V-1917 Tie In to KO Drum	S-1035	N-1040	N-1030	20"	20	19.250	0.012	508	3	67.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	575.4
V-1912 to V-1917 Tie In	S-1045	N-1050	N-1040	20"	20	19.250	0.012	25	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	25.0
Sulfatreat to V-1912 Tie In	S-1055	N-1060	N-1050	20"	20	19.250	0.012	65	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	4.8	69.8
Compressor Sub to Sulfatreat Tie In	S-1065	N-1070	N-1060	20"	20	19.250	0.012	25	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	25.0
Common Compressor Subheader @1	S-1075	N-2000	N-1070	12"	STD	12.000	0.013	23	2	28.0	0	0.0	0	0.0	0	0.0	1	60.0	1	3.0	114.0
West Compressor Subheader #1	S-2005	N-2010	N-2000	12"	STD	12.000	0.013	52	0	0.0	0	0.0	0	0.0	0	0.0	1	60.0	0	0.0	112.0
West Compressor Subheader #2	S-2035	N-2040	N-2010	12"	STD	12.000	0.013	60	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	80.0
C-1052 Subheader #1	S-2045	N-2050	N-2040	8"	40	7.981	0.014	28	0	0.0	2	10.6	0	0.0	0	0.0	1	39.9	1	2.0	80.5
C-1052 Subheader #2	S-2055	N-2060	N-2050	8"	40	7.981	0.014	1	0	0.0	2	10.6	0	0.0	1	13.3	0	0.0	1	2.0	26.9
C-1052 Subheader #3	S-2075	N-2080	N-2060	8"	40	7.981	0.014	17	1	9.3	2	10.6	0	0.0	0	0.0	0	0.0	0	0.0	37.0
C-1052 Subheader #4	S-2095	N-2100	N-2080	8"	40	7.981	0.014	5	0	0.0	0	0.0	0	0.0	1	13.3	0	0.0	0	0.0	18.3
PSV-1052A to Subheader	**S-2105**	**N-2110**	**N-2100**	**3"**	**40**	**3.068**	**0.018**	**6**	**1**	**3.6**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**9.6**
West Compressor Subheader #2	S-2155	N-2160	N-2040	12"	STD	12.000	0.013	60	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	80.0
C-1051 Subheader #1	S-2165	N-2170	N-2160	8"	40	7.981	0.014	26	1	9.3	2	10.6	0	0.0	0	0.0	1	39.9	1	2.0	87.9
C-1051 Subheader #2	S-2175	N-2180	N-2170	8"	40	7.981	0.014	7	1	9.3	2	10.6	0	0.0	1	13.3	0	0.0	0	0.0	40.3
C-1051 Subheader #3	S-2205	N-2210	N-2180	8"	40	7.981	0.014	10	0	0.0	2	10.6	0	0.0	0	0.0	0	0.0	0	0.0	20.6
C-1051 Subheader #4	S-2225	N-2230	N-2210	8"	40	7.981	0.014	5	0	0.0	0	0.0	0	0.0	1	13.3	0	0.0	0	0.0	18.3
PSV-1051A to Subheader	**S-2235**	**N-2240**	**N-2230**	**3"**	**40**	**3.068**	**0.018**	**6**	**1**	**3.6**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**9.6**
East Compressor Subheader	S-2215	N-2220	N-2000	12"	STD	12.000	0.013	128	0	0.0	0	0.0	0	0.0	1	20.0	1	60.0	0	0.0	208.0
C-1057 Subheader #1	S-2225	N-2230	N-2220	6"	40	6.065	0.015	41	0	0.0	1	4.0	0	0.0	0	0.0	0	0.0	1	1.5	46.6
C-1057 Subheader #2	S-2245	N-2250	N-2230	6"	40	6.065	0.015	18	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	18.0
C-1057 Subheader #3	S-2265	N-2270	N-2250	6"	40	6.065	0.015	8	2	14.2	2	8.1	0	0.0	1	10.1	0	0.0	0	0.0	40.3
PSV-1057A to Subheader	**S-2275**	**N-2280**	**N-2270**	**3"**	**40**	**3.068**	**0.018**	**1**	**1**	**3.6**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**4.6**

Targa Resources LLC
Valley Wells Compressor Station
Blocked Facility Outlet - 3 of 5 Compressor Running (C-1051, 1052 & 1057)
Flare Knockout Drum Evaluation

Inputs		
Density (Liquid)	40.00	lb/ft^3
Total Liquid In Flow	0	BPD
Low Liquid Level	7%	
Normal Liquid Level	14%	
High Liquid Level	30%	
Minimum Droplet Size	723	microns
Vessel Inner Diameter	6	ft
Selected Vessel Length	20	ft
Results from Hydraulic Evaluation		
Vapor Flowrate	79.14	MMSCFD
Operating Temperature	194.50	F
Operating Pressure	6.77	psig
Atmospheric Pressure	14.7	psia
MW (Vapor)	21.79	
Viscosity (Vapor)	0.01	cp
Density (Vapor)	0.067	lb/ft^3
Mass Flowrate	52.7	lb/s
Volumetric Flowrate	786.0	ft^3/sec
Calculate Terminal Settling Velocity		
Minimum Droplet Size	0.002372	ft
c'(Re)^2	33916.0	
Drag Coefficient C'	0.71	
Terminal Settling Velocity	9.22	ft/s
Calculate Vessel Nozzle Separation Based on Low Level		
Full Area	28.3	ft^2
Required Fall Distance	5.6	ft
Required Residence Time	0.6	sec
Gas Velocity	27.80	ft/sec
Min. Nozzle Separation	16.8	ft
Calculate Vessel Nozzle Separation Based on Normal Level		
Level	0.8	ft
Required Fall Distance	5.2	ft
Required Residence Time	0.6	sec
α	43.9	degrees
x	2.1	ft
Circular Area	21.4	ft^2
Triangle Area	4.5	ft^2
Cross-Sectional Area	25.9	ft^2
Gas Velocity	30.38	ft/sec
Min. Nozzle Separation	17.0	ft
Calculate Vessel Nozzle Separation Based on High Level		
Level	1.8	ft
Required Fall Distance	4.2	ft
Required Residence Time	0.5	sec
α	66.4	degrees
x	2.7	ft
Circular Area	17.8	ft^2
Triangle Area	3.3	ft^2
Cross-Sectional Area	21.1	ft^2
Gas Velocity	37.18	ft/sec
Min. Nozzle Separation	16.9	ft

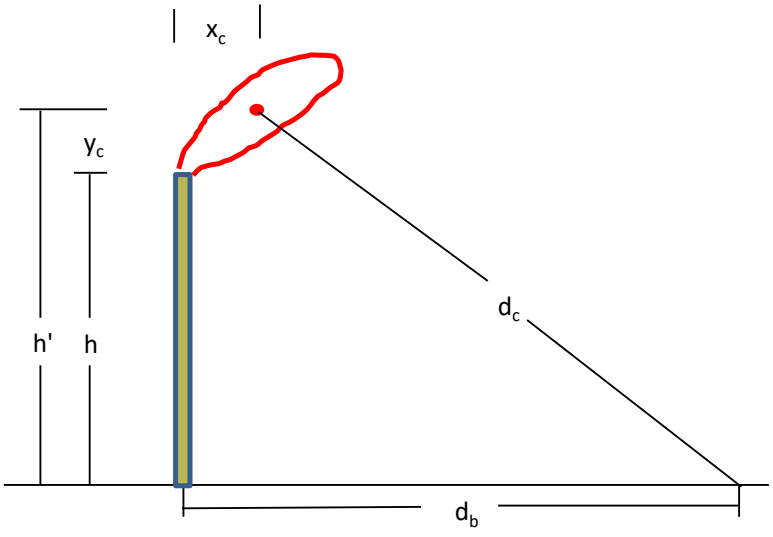
Targa Resources LLC
Valley Wells Compressor Station
Blocked Facility Outlet - 3 of 5 Compressor Running (C-1051, 1052 & 1057)
Flare Tip Radiation and Exit Velocity

Inputs

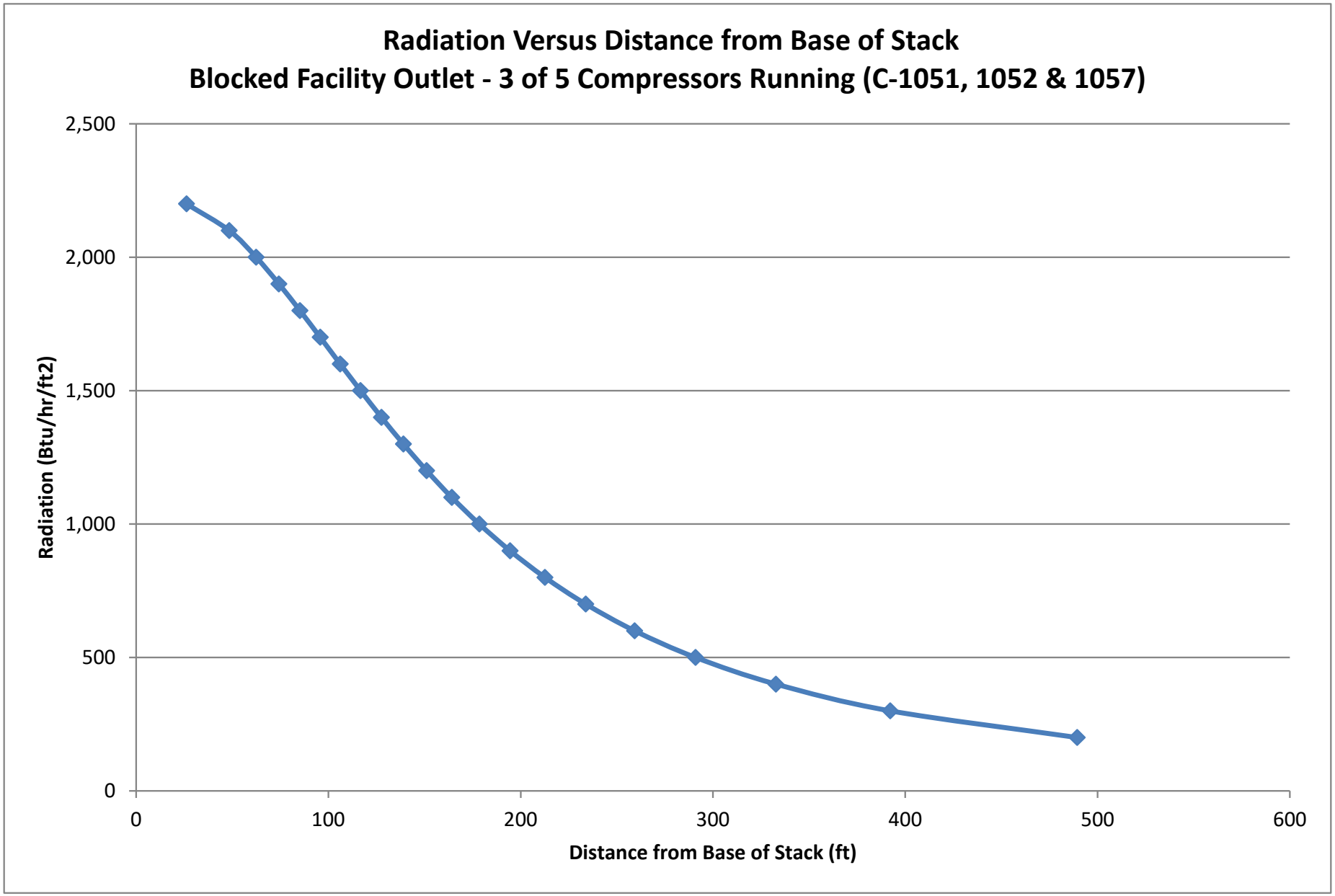
Atmsopheric Pressure	P_{atm}	14.7	psia
Mass Flowrate	q_m	189,329	lb/hr
Temperature	T_j	194	F
Molecular Weight	M_j	21.79	lb/lbmole
Compressibility	Z_j	0.99	
Heat of Combustion	LHV	20,693	Btu/lb
Flare Inner Diameter	d_j	1.17	ft
Flare Height	h	100	ft
Fraction Heat Radiated	F	0.16	
Wind Speed	u_j	20	mph
Ambient Temperature	T_∞	60	F
Horizontal Distance to Flame Center	x_c	13	ft
Vertical Distance to Flame Center	y_c	50	ft

Outputs

Exit Mach Number	Ma_2	0.88	
Isothermal Sonic Velocity	u_s	1222.1	ft/sec
Exit Velocity	u_j	1073.2	ft/sec
Mixture LEL	C_L	4.82	vol %
Wind Speed	u_j	29.3	ft/sec
LEL Concentration Parameter	C_L-	1.326	
Jet and Wind Thrust	d_jR	177.6	
Heat Released	Q	3,918	MMBtu/hr
Flame Center Height	h'	150	ft



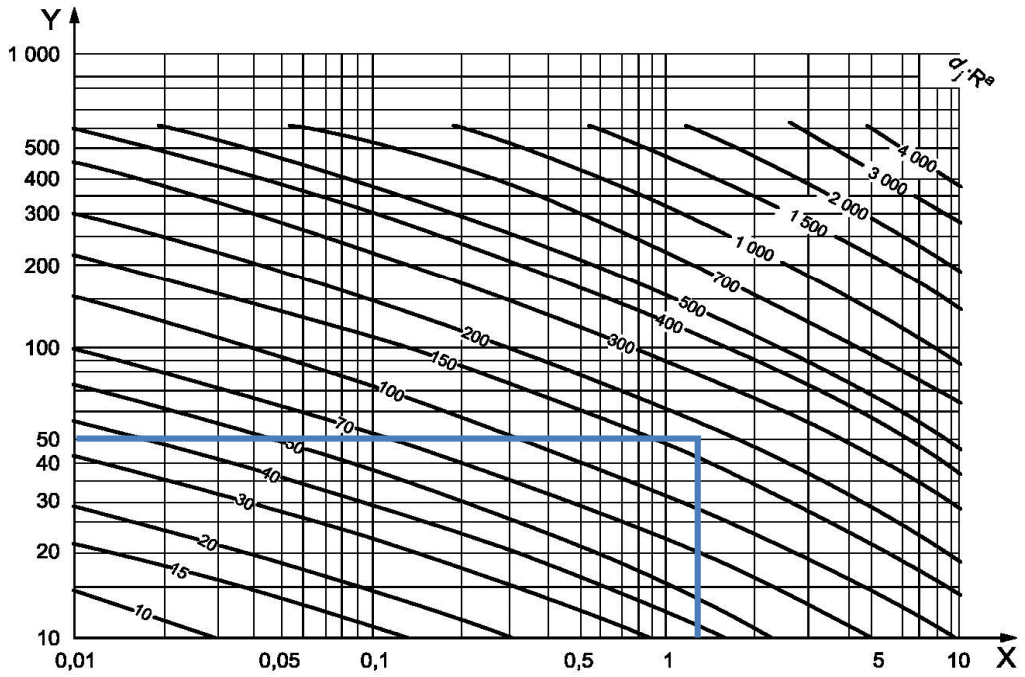
Radiation Level	Distance from Base d_b (ft)	Distance from Center d_c (ft)
200	489	499
300	392	408
400	333	353
500	291	316
600	259	288
700	234	267
800	213	250
900	194	235
1,000	178	223
1,100	164	213
1,200	151	204
1,300	139	196
1,400	128	189
1,500	117	182
1,600	106	177
1,700	96	171
1,800	85	166
1,900	74	162
2,000	62	158
2,100	48	154
2,200	26	151
2,300	N/A	147
2,350	N/A	146
2,450	N/A	143
2,550	N/A	140


Radiation Versus Distance from Base of Stack
Blocked Facility Outlet - 3 of 5 Compressors Running (C-1051, 1052 & 1057)
Radiation (Btu/hr/ft2)
2,500
2,000
1,500
1,000
500
0
0
100
200
300
400
500
600
Distance from Base of Stack (ft)

Targa Resources LLC
Valley Wells Compressor Station
Blocked Facility Outlet - 3 of 5 Compressor Running (C-1051, 1052 & 1057)
Flare Gas LEL Calculation

Component	LEL (Vol %)	Gross Heating Value (Btu/scf)	Net Heating Value (Btu/scf)	MW	Mole Fraction	LEL Contribution (%)	HHV Contribution (Btu/scf)	LHV Contribution (Btu/scf)
Hydrogen Sulfide	4.3	1,573.4	1,450.6	34.08	0.0003	0.00129	0.5	0.4
Nitrogen	100.0	-	-	28.01	0.0016	0.16000	0.0	0.0
Methane	5.0	1,010.0	909.4	16.04	0.7626	3.81300	770.2	693.5
Carbon Dioxide	100.0	-	-	44.01	0.0027	0.27000	0.0	0.0
Ethane	3.0	1,769.7	1,618.7	30.07	0.1316	0.39480	232.9	213.0
Propane	2.1	2,516.2	2,314.9	44.10	0.0578	0.12138	145.4	133.8
Butane	1.6	3,262.4	3,010.8	58.12	0.0193	0.03088	63.0	58.1
Isobutane	1.6	3,252.0	3,000.4	58.12	0.0084	0.01344	27.3	25.2
Pentane	1.4	4,008.7	3,706.9	72.15	0.0053	0.00742	21.2	19.6
Isopentane	1.3	4,000.9	3,699.0	72.15	0.0047	0.00611	18.8	17.4
Hexane	1.1	4,756.0	4,403.8	86.18	0.0015	0.00165	7.1	6.6
Cyclohexane	1.3	4,443.5	4,144.6	84.16	0.0010	0.00130	4.4	4.1
Heptane	1.1	5,502.5	5,100.0	100.20	0.0004	0.00044	2.2	2.0
Octane	1.0	6,248.9	5,796.0	114.23	0.0012	0.00120	7.5	7.0
Benzene	1.2	3,741.9	3,590.9	78.11	0.0007	0.00084	2.6	2.5
Ethylbenzene	1.0	5,222.0	4,970.4	106.17	0.0009	0.00090	4.7	4.5
					1.0000	4.82465	1,308	1,188

Mixture MW	**21.78**	**lb/lbmole**
Mixture LEL	**4.82**	**Vol %**
Mixture HHV	**1,308**	**Btu/scf**
Mixture HHV	**22,786**	**Btu/lbm**
Mixture LHV	**1,188**	**Btu/scf**
Mixture LHV	**20,693**	**Btu/lbm**



Key

X $\overline{C_L}$, the lower-explosive-limit concentration parameter for the flare gas, see Equation (C.7)

Y y_c, vertical distance from the stack to flame centre, expressed in feet

[a] $(d_j \cdot R)$ is the parameter for jet thrust and wind thrust, see Equation (C.8).

Figure C.5 — Flame centre for flares and ignited vents — Vertical distance, y_c (USC units)

C.3.4 Calculation of the distance from the flame centre to the object or point being considered

The design basis for this calculation is as follows: The fraction of heat radiated, F, is 0,3. The heat liberated (see C.2.3), Q, is $6{,}3 \times 10^6$ kW ($2{,}15 \times 10^{10}$ Btu/h). Say the flare stack design must limit the maximum allowable radiation (see 6.4.2.3), K, is 9,5 kW/m^2 (3 000 Btu/h·ft^2).

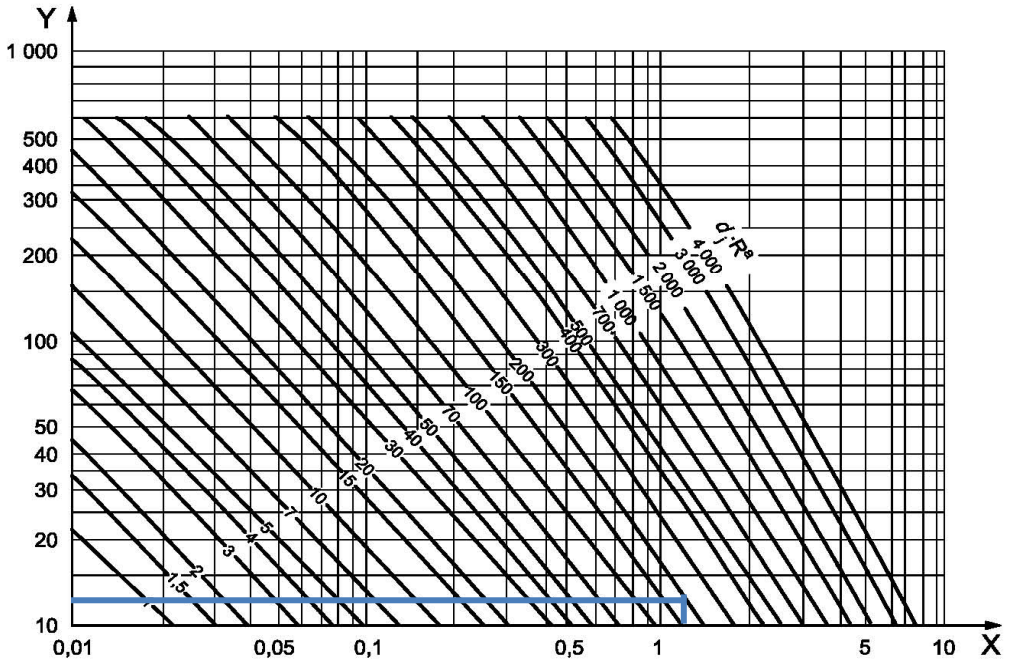
In Equation (24), the value of τ should be assumed to be 1,0 (see C.3.6.3 and C.3.6.4). The distance from the flame centre to the object or point being considered (that is, the distance to the limit of the radiant heat intensity, such as grade level, an equipment platform, or a plant boundary), D, is then calculated as follows:

$$D = \sqrt{\frac{\tau \cdot F \cdot Q}{4\pi \cdot K}} \tag{24}$$

In SI units:

$$D = \sqrt{\frac{1{,}0 \times 0{,}3 \times 6{,}3 \times 10^6}{4\pi \times 9{,}5}} = 126 \text{ m}$$

API Standard 521 / ISO 23251



Key

X $\overline{C_L}$, the lower-explosive-limit concentration parameter for the flare gas, see Equation (C.7)

Y x_c, horizontal distance from the stack to flame centre, expressed in feet

[a] $(d_j \cdot R)$ is the parameter for jet thrust and wind thrust, see Equation (C.8).

Figure C.3 — Flame centre for flares and ignited vents — Horizontal distance, x_c (USC units)

Blocked Reciprocating Compressor

Equipment Data:

Equipment Tag:	**V-9432 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03C	MAWP:	1450 psig
Description:	C-1051 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Description:

In the event that of a blocked discharge, this reciprocating compressor could be overpressured. The relief requirement was based on the normal suction gas composition with the 3rd stage suction set at the PSHH set point of 570 psig (per recommendation for PSHH reset on PSV-1051B) and 120 F. The mechanical characteristics of the compressor at 1,000 rpm and minimum clearances were used in the evaluation.

Scenario Calculation Results:

Required Rate:	19.7	MMSCFD	Device Choke Pressure:	889.7	psig
Actual Capacity:	29.4	MMSCFD	Outlet Temperature:	190.6	F
Required Area:	0.577	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.865	in2	Outlet Density:	0.045	lb/ft3
Relief Pressure:	1584.0	psig	Outlet Ideal Cp/Cv:	1.207	
Relief Temperature:	259.8	F	Outlet Viscosity:	0.012	cP
Relief MW:	21.78		Inlet Non-Recoverble dP:	10.7	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.7	% Set
Relief Density:	5.093	lb/ft3	Built-Up Back Pressure:	147.5	psig
Relief SG:	0.751		Built-Up Back P % Set:	10.2	% Set
Relief Z:	0.89		Total Back Pressure:	147.5	psig
Relief Ideal Cp/Cv:	1.194		Total Back P % Set:	10.2	% Set
Relief Viscosity:	0.013	cP			

Exit Velocity at Reseat Capacity is too low.

Blocked Reciprocating Compressor

Equipment Data:

Equipment Tag:	**V-9432 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03C	MAWP:	1450 psig
Description:	C-1051 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Input Data:

Gas Type:	Inlet Gas	
Number of Cylinders:	1	
Cylinder Type:	Double Acting	
Compressor RPM	1000	
Compressor Stroke	6.75	in
Cylinder Diameter:	9.125	in
Rod Diameter:	2.875	in
Head End Clearance %:	15.59	%
Crank End Clearance %:	18.38	%
Suction Valve Losses %:	7	%
Discharge Valve Losses %:	7	%
Required Relief Rate Units:	MMSCFD	
Suction Pressure:	570	psig
Dewpoint Vapor:	☐	
Suction Temperature:	120	F
Set Pressure:	1440	psig
Allowable Overpressure:	10.0%	
Device Outlet Pressure:	0	psig
Use Thermo	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.818	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	

Scenario Output Data:

HE Displacement:	255.5	acfm
CE Displacement:	230.1	acfm
HE Volumetric Efficiency:	70.7	%
CE Volumetric Efficiency:	67.2	%
Compression Ratio:	2.735	
Suction Z:	0.876	
Suction Ideal Cp/Cv:	1.222	
Required Mass Rate:	46,985.0	lb/hr
Required Rate Std. Voluime:	19.65	MMSCFD
Required Air Rate:	834,717.5	scfh air
Relief Mass Flux:	3255.4	lb/sec/ft2

Notes:

Blocked Reciprocating Compressor

Equipment Data:

Equipment Tag:	**V-9432 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03C	MAWP:	1450 psig
Description:	C-1051 3rd Stage Discharge Bottle	MAWT:	350 F

Relief Stream Composition:

Stream Description: Valley Wellls 3rd Suction Gas

Component	Mole Fraction
hydrogen sulfide	0.0003
nitrogen	0.0016
methane	0.7626
carbon dioxide	0.0027
ethane	0.1316
propane	0.0578
butane	0.0193
isobutane	0.0084
ipentane	0.0053
isopentane	0.0047
hexane	0.0015
cyclohexane	0.0010
heptane	0.0003
octane	0.0012
benzene	0.0007
ethylbenzene	0.0009

Blocked Reciprocating Compressor

Equipment Data:

Equipment Tag:	**V-9432 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04C	MAWP:	1450 psig
Description:	C-1052 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Description:

In the event that of a blocked discharge, this reciprocating compressor could be overpressured. The relief requirement was based on the normal suction gas composition with the 3rd stage suction set at the PSHH set point of 570 psig (per recommendation for PSHH reset on PSV-1051B) and 120 F. The mechanical characteristics of the compressor at 1,000 rpm and minimum clearances were used in the evaluation.

Scenario Calculation Results:

Required Rate:	19.7	MMSCFD	Device Choke Pressure:	889.7	psig
Actual Capacity:	29.4	MMSCFD	Outlet Temperature:	190.6	F
Required Area:	0.577	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.865	in2	Outlet Density:	0.045	lb/ft3
Relief Pressure:	1584.0	psig	Outlet Ideal Cp/Cv:	1.207	
Relief Temperature:	259.8	F	Outlet Viscosity:	0.012	cP
Relief MW:	21.78		Inlet Non-Recoverble dP:	10.7	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.7	% Set
Relief Density:	5.093	lb/ft3	Built-Up Back Pressure:	147.5	psig
Relief SG:	0.751		Built-Up Back P % Set:	10.2	% Set
Relief Z:	0.89		Total Back Pressure:	147.5	psig
Relief Ideal Cp/Cv:	1.194		Total Back P % Set:	10.2	% Set
Relief Viscosity:	0.013	cP			

Exit Velocity at Reseat Capacity is too low.

Blocked Reciprocating Compressor

Equipment Data:

Equipment Tag:	**V-9432 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04C	MAWP:	1450 psig
Description:	C-1052 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Input Data:

Gas Type:	Inlet Gas	
Number of Cylinders:	1	
Cylinder Type:	Double Acting	
Compressor RPM	1000	
Compressor Stroke	6.75	in
Cylinder Diameter:	9.125	in
Rod Diameter:	2.875	in
Head End Clearance %:	15.59	%
Crank End Clearance %:	18.38	%
Suction Valve Losses %:	7	%
Discharge Valve Losses %:	7	%
Required Relief Rate Units:	MMSCFD	
Suction Pressure:	570	psig
Dewpoint Vapor:	☐	
Suction Temperature:	120	F
Set Pressure:	1440	psig
Allowable Overpressure:	10.0%	
Device Outlet Pressure:	0	psig
Use Thermo	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.818	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	

Scenario Output Data:

HE Displacement:	255.5	acfm
CE Displacement:	230.1	acfm
HE Volumetric Efficiency:	70.7	%
CE Volumetric Efficiency:	67.2	%
Compression Ratio:	2.735	
Suction Z:	0.876	
Suction Ideal Cp/Cv:	1.222	
Required Mass Rate:	46,985.0	lb/hr
Required Rate Std. Voluime:	19.65	MMSCFD
Required Air Rate:	834,717.5	scfh air
Relief Mass Flux:	3255.4	lb/sec/ft2

Notes:

Blocked Reciprocating Compressor

Equipment Data:

Equipment Tag:	**V-9432 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04C	MAWP:	1450 psig
Description:	C-1052 3rd Stage Discharge Bottle	MAWT:	350 F

Relief Stream Composition:

Stream Description: Valley Wellls 3rd Suction Gas

Component	Mole Fraction
hydrogen sulfide	0.0003
nitrogen	0.0016
methane	0.7626
carbon dioxide	0.0027
ethane	0.1316
propane	0.0578
butane	0.0193
isobutane	0.0084
ipentane	0.0053
isopentane	0.0047
hexane	0.0015
cyclohexane	0.0010
heptane	0.0003
octane	0.0012
benzene	0.0007
ethylbenzene	0.0009

Blocked Reciprocating Compressor

Equipment Data:

Equipment Tag:	**V-9432 (C-1057)**	Type:	Pressure Vessel
Drawing:	D-2415-F-09C	MAWP:	1450 psig
Description:	C-1057 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Description:

In the event that of a blocked discharge, this reciprocating compressor could be overpressured. The relief requirement was based on the normal suction gas composition with the 3rd stage suction set at the PSHH set point of 525 psig and 120 F. The mechanical characteristics of the compressor at 1,000 rpm and minimum clearances were used in the evaluation.

Scenario Calculation Results:

Required Rate:	10.1	MMSCFD	Device Choke Pressure:	890.3	psig
Actual Capacity:	11.3	MMSCFD	Outlet Temperature:	203.7	F
Required Area:	0.301	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.337	in2	Outlet Density:	0.044	lb/ft3
Relief Pressure:	1584.0	psig	Outlet Ideal Cp/Cv:	1.204	
Relief Temperature:	270.2	F	Outlet Viscosity:	0.012	cP
Relief MW:	21.78		Inlet Non-Recoverble dP:	1.6	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.1	% Set
Relief Density:	4.976	lb/ft3	Built-Up Back Pressure:	128.5	psig
Relief SG:	0.751		Built-Up Back P % Set:	8.9	% Set
Relief Z:	0.89		Total Back Pressure:	128.5	psig
Relief Ideal Cp/Cv:	1.192		Total Back P % Set:	8.9	% Set
Relief Viscosity:	0.013	cP			

Exit Velocity at Reseat Capacity is too low.

Blocked Reciprocating Compressor

Equipment Data:

Equipment Tag:	**V-9432 (C-1057)**	Type:	Pressure Vessel
Drawing:	D-2415-F-09C	MAWP:	1450 psig
Description:	C-1057 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Input Data:

Gas Type:	Inlet Gas	
Number of Cylinders:	1	
Cylinder Type:	Double Acting	
Compressor RPM	1000	
Compressor Stroke	6.5	in
Cylinder Diameter:	7.25	in
Rod Diameter:	2.5	in
Head End Clearance %:	16.46	%
Crank End Clearance %:	19.71	%
Suction Valve Losses %:	7	%
Discharge Valve Losses %:	7	%
Required Relief Rate Units:	MMSCFD	
Suction Pressure:	525	psig
Dewpoint Vapor:	☐	
Suction Temperature:	120	F
Set Pressure:	1440	psig
Allowable Overpressure:	10.0%	
Device Outlet Pressure:	0	psig
Use Thermo	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.818	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	

Scenario Output Data:

HE Displacement:	155.3	acfm
CE Displacement:	136.8	acfm
HE Volumetric Efficiency:	66.82	%
CE Volumetric Efficiency:	62.23	%
Compression Ratio:	2.963	
Suction Z:	0.885	
Suction Ideal Cp/Cv:	1.222	
Required Mass Rate:	24,186.7	lb/hr
Required Rate Std. Voluime:	10.11	MMSCFD
Required Air Rate:	432,799.9	scfh air
Relief Mass Flux:	3215.6	lb/sec/ft2

Notes:

Blocked Reciprocating Compressor

Equipment Data:

Equipment Tag:	**V-9432 (C-1057)**	Type:	Pressure Vessel
Drawing:	D-2415-F-09C	MAWP:	1450 psig
Description:	C-1057 3rd Stage Discharge Bottle	MAWT:	350 F

Relief Stream Composition:

Stream Description: Valley Wellls 3rd Suction Gas

Component	Mole Fraction
hydrogen sulfide	0.0003
nitrogen	0.0016
methane	0.7626
carbon dioxide	0.0027
ethane	0.1316
propane	0.0578
butane	0.0193
isobutane	0.0084
ipentane	0.0053
isopentane	0.0047
hexane	0.0015
cyclohexane	0.0010
heptane	0.0003
octane	0.0012
benzene	0.0007
ethylbenzene	0.0009

APPENDIX D – Fire Zone #1 – C-1051 & C-1052 Details

Hydraulic Detailed Results

Knockout Drum Detailed Results

Flare Detailed Sizing Results

Relief Load Calculations

RKR ENGINEERING

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #1 - C-1051 and C-1052

Client:	Targa Resources LLC		Increments/Seg.	5	
Project:	Valley Wells Compressor Station		P Atm	14.7	psia
Project Number:	23-1005		Exit Pressure	2	psig
Date:	Mar-24		Roughness	0.00015	feet
Created by:	Rob Kreder		Friction dP Only	FALSE	

Input Data						Calculated Values						Inlet Conditions				Exit Conditions				Results				
Description	Segment	Start Node	End Node	Pipe NPS	Pipe Sch	Pipe ID (inches)	Equivalent Length (ft)	Segment Flow (lb/hr)	Segment Flow (MMSCFD)	Moody f	Fluid MW	P_1 (psig)	T_1 (F)	K_1	ρ_1 (lb/ft^3)	P_2 (psig)	T_2 (F)	K_2	Z_2	Segment ΔP (psi)	Max. Velocity (ft/sec)	Sonic Velocity (ft/sec)	Segment Max. Mach Number	Choke P at Segment Exit (psig)
Reducer To Flare Base	S-1005	N-1010	N-1000	12"	STD	12.000	2.0	38,319	7.03	0.014	49.65	2.1	499.4	1.071	0.081	2.0	499.4	1.071	0.081	0.0	167.3	1014.5	0.16	-11.9
KO Drum to Reducer	S-1015	N-1020	N-1010	20"	20	19.250	86.4	38,319	7.03	0.013	49.65	2.1	499.4	1.071	0.081	2.1	499.4	1.071	0.081	0.0	65.0	1014.5	0.06	-13.6
KO Drum	S-1025	N-1030	N-1020	20"	20	19.250	66.8	38,319	7.03	0.013	49.65	2.2	499.4	1.071	0.082	2.1	499.4	1.071	0.081	0.0	65.0	1014.5	0.06	-13.6
V-1917 Tie In to KO Drum	S-1035	N-1040	N-1030	20"	20	19.250	575.4	38,319	7.03	0.013	49.65	2.3	499.4	1.071	0.083	2.2	499.4	1.071	0.082	0.2	64.2	1014.5	0.06	-13.6
V-1912 to V-1917 Tie In	S-1045	N-1050	N-1040	20"	20	19.250	25.0	38,319	7.03	0.013	49.65	2.4	499.4	1.071	0.083	2.3	499.4	1.071	0.083	0.0	63.5	1014.5	0.06	-13.6
Sulfatreat to V-1912 Tie In	S-1055	N-1060	N-1050	20"	20	19.250	69.8	38,319	7.03	0.013	49.65	2.4	499.4	1.071	0.083	2.4	499.4	1.071	0.083	0.0	63.5	1014.5	0.06	-13.6
Compressor Sub to Sulfatreat Tie In	S-1065	N-1070	N-1060	20"	20	19.250	25.0	38,319	7.03	0.013	49.65	2.5	499.4	1.071	0.083	2.4	499.4	1.071	0.083	0.0	63.5	1014.5	0.06	-13.6
Common Compressor Subheader @1	S-1075	N-2000	N-1070	12"	STD	12.000	114.0	38,319	7.03	0.014	49.65	2.9	499.4	1.071	0.085	2.5	499.4	1.071	0.083	0.4	163.3	1014.5	0.16	-11.9
West Compressor Subheader #1	S-2005	N-2010	N-2000	12"	STD	12.000	112.0	38,319	7.03	0.014	49.65	3.3	499.4	1.071	0.087	2.9	499.4	1.071	0.085	0.4	159.4	1014.5	0.16	-11.9
West Compressor Subheader #2	S-2035	N-2040	N-2010	12"	STD	12.000	80.0	38,319	7.03	0.014	49.65	3.6	499.5	1.071	0.089	3.3	499.4	1.071	0.087	0.3	155.8	1014.5	0.15	-11.9
C-1052 Subheader #1	S-2045	N-2050	N-2040	8"	40	7.981	80.5	19,160	3.51	0.015	49.65	4.1	499.5	1.071	0.091	3.6	499.5	1.071	0.089	0.5	172.1	1014.5	0.17	-11.6
C-1052 Subheader #2	S-2055	N-2060	N-2050	8"	40	7.981	26.9	6,380	1.98	0.016	29.31	4.2	273.2	1.144	0.071	4.1	273.2	1.144	0.070	0.0	72.9	1192.9	0.06	-13.6
PSV-1052E to Subheader 2"	S-2063	N-2065	N-2060	2"	80	1.939	16.3	324	0.18	0.022	16.67	4.3	236.7	1.258	0.043	4.2	236.7	1.258	0.042	0.1	104.4	1617.0	0.06	-13.5
PSV-1052E to Subheader 1"	**S-2068**	**N-2070**	**N-2065**	**1"**	**80**	**0.957**	**8.5**	**324**	**0.18**	**0.024**	**16.67**	**6.5**	**236.8**	**1.258**	**0.047**	**4.3**	**236.7**	**1.258**	**0.043**	**2.2**	**418.6**	**1617.0**	**0.26**	**-9.7**
C-1052 Subheader #3	S-2075	N-2080	N-2060	8"	40	7.981	37.0	6,056	1.81	0.016	30.54	4.2	269.3	1.139	0.074	4.2	269.2	1.139	0.074	0.0	65.4	1162.9	0.06	-13.6
PSV-1052B to Subheader	**S-2085**	**N-2090**	**N-2080**	**4"**	**40**	**4.026**	**31.0**	**4,628**	**1.21**	**0.017**	**34.85**	**4.7**	**228.2**	**1.127**	**0.092**	**4.2**	**228.1**	**1.127**	**0.090**	**0.4**	**161.6**	**1051.9**	**0.15**	**-11.8**
C-1052 Subheader #4	S-2095	N-2100	N-2080	8"	40	7.981	18.3	1,428	0.60	0.020	21.79	4.3	393.9	1.171	0.045	4.2	393.9	1.171	0.045	0.0	25.4	1510.6	0.02	-14.4
PSV-1052A to Subheader	**S-2105**	**N-2110**	**N-2100**	**3"**	**40**	**3.068**	**9.6**	**1,428**	**0.60**	**0.019**	**21.79**	**4.4**	**393.9**	**1.171**	**0.046**	**4.3**	**393.9**	**1.171**	**0.045**	**0.1**	**171.8**	**1510.6**	**0.11**	**-12.6**
C-1052 Subheader #5	S-2115	N-2120	N-2050	8"	40	7.981	41.9	12,780	1.53	0.015	76.01	4.2	450.2	1.049	0.149	4.1	450.2	1.049	0.149	0.1	68.6	790.4	0.09	-13.1
C-1052 Subheader #6	S-2125	N-2130	N-2120	6"	40	6.065	26.1	12,780	1.53	0.015	76.01	4.4	450.2	1.049	0.151	4.2	450.2	1.049	0.149	0.2	118.8	790.4	0.15	-11.9
PSV-1052 NEW to Subheader	**S-2135**	**N-2140**	**N-2130**	**3"**	**40**	**3.068**	**22.9**	**8,910**	**0.91**	**0.018**	**89.34**	**6.9**	**456.3**	**1.042**	**0.200**	**4.4**	**456.0**	**1.042**	**0.177**	**2.4**	**272.4**	**728.9**	**0.37**	**-7.6**
PSV-1052C to Subheader	**S-2145**	**N-2150**	**N-2130**	**6"**	**40**	**6.065**	**62.3**	**3,870**	**0.62**	**0.016**	**56.56**	**4.5**	**350.6**	**1.071**	**0.127**	**4.4**	**350.6**	**1.071**	**0.126**	**0.1**	**42.5**	**873.7**	**0.05**	**-13.8**
West Compressor Subheader #2	S-2155	N-2160	N-2040	12"	STD	12.000	80.0	19,160	3.51	0.014	49.65	3.7	499.5	1.071	0.089	3.6	499.5	1.071	0.089	0.1	76.1	1014.5	0.08	-13.3
C-1051 Subheader #1	S-2165	N-2170	N-2160	8"	40	7.981	87.9	19,160	3.51	0.015	49.65	4.3	499.5	1.071	0.092	3.7	499.5	1.071	0.089	0.6	172.1	1014.5	0.17	-11.6
C-1051 Subheader #2	S-2175	N-2180	N-2170	8"	40	7.981	40.3	6,380	1.98	0.016	29.31	4.3	273.3	1.144	0.071	4.3	273.3	1.144	0.071	0.0	71.8	1193.0	0.06	-13.6
PSV-1051E to Subheader 2"	S-2185	N-2190	N-2180	2"	80	1.939	13.3	324	0.18	0.022	16.67	4.4	236.7	1.258	0.043	4.3	236.7	1.258	0.043	0.1	102.0	1617.0	0.06	-13.5
PSV-1051E to Subheader 1"	**S-2195**	**N-2200**	**N-2190**	**1"**	**80**	**0.957**	**8.0**	**324**	**0.18**	**0.024**	**16.67**	**6.5**	**236.8**	**1.258**	**0.047**	**4.4**	**236.7**	**1.258**	**0.043**	**2.1**	**418.6**	**1617.0**	**0.26**	**-9.7**
C-1051 Subheader #3	S-2205	N-2210	N-2180	8"	40	7.981	20.6	6,056	1.81	0.016	30.54	4.4	269.3	1.139	0.075	4.3	269.3	1.139	0.075	0.0	64.6	1163.0	0.06	-13.6
PSV-1051B to Subheader	**S-2215**	**N-2220**	**N-2210**	**4"**	**40**	**4.026**	**31.0**	**4,628**	**1.21**	**0.017**	**34.85**	**4.8**	**228.2**	**1.127**	**0.093**	**4.4**	**228.1**	**1.127**	**0.091**	**0.4**	**159.8**	**1051.9**	**0.15**	**-11.8**
C-1051 Subheader #4	S-2225	N-2230	N-2210	8"	40	7.981	18.3	1,428	0.60	0.020	21.79	4.4	393.9	1.171	0.046	4.4	393.9	1.171	0.045	0.0	25.4	1510.6	0.02	-14.4
PSV-1051A to Subheader	**S-2235**	**N-2240**	**N-2230**	**3"**	**40**	**3.068**	**9.6**	**1,428**	**0.60**	**0.019**	**21.79**	**4.6**	**393.9**	**1.171**	**0.046**	**4.4**	**393.9**	**1.171**	**0.046**	**0.1**	**168.0**	**1510.6**	**0.11**	**-12.6**
C-1051 Subheader #5	S-2245	N-2250	N-2170	8"	40	7.981	41.9	12,780	1.53	0.015	76.01	4.4	450.2	1.049	0.151	4.3	450.2	1.049	0.150	0.1	68.1	790.4	0.09	-13.1
C-1051 Subheader #6	S-2255	N-2260	N-2250	6"	40	6.065	26.1	12,780	1.53	0.015	76.01	4.6	450.2	1.049	0.152	4.4	450.2	1.049	0.151	0.2	117.2	790.4	0.15	-11.9
PSV-1051 NEW to Subheader	**S-2265**	**N-2270**	**N-2260**	**3"**	**40**	**3.068**	**22.9**	**8,910**	**0.91**	**0.018**	**89.34**	**7.0**	**456.3**	**1.042**	**0.201**	**4.6**	**456.1**	**1.042**	**0.179**	**2.4**	**269.3**	**728.9**	**0.37**	**-7.6**
PSV-1051C to Subheader	**S-2275**	**N-2280**	**N-2260**	**6"**	**40**	**6.065**	**62.3**	**3,870**	**0.62**	**0.016**	**56.56**	**4.6**	**350.6**	**1.071**	**0.127**	**4.6**	**350.6**	**1.071**	**0.127**	**0.0**	**42.2**	**873.7**	**0.05**	**-13.8**

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #1 - C-1051 and C-1052

Client:	Targa Resources LLC
Project:	Valley Wells Compressor Station
Project Number:	23-1005
Date:	Mar-24
Created by:	Rob Kreder

Segment Data

Description	Segment	Start Node	End Node	Pipe NPS	Pipe Sch	Pipe ID (inches)	Moody F	Pipe Length (ft)	# 90 Elbows	Eq. Length 90 Elbows	# 45 Elbows	Eq. Length 45 Elbows	Entrances	Eq. Length Entrances	Tee Through	Eq. Length Tee Through	Tee Branch	Eq. Length Tee Branch	Ball Valve	Eq. Length Ball Valve	Equivalent Length (ft)
Reducer To Flare Base	S-1005	N-1010	N-1000	12"	STD	12.000	0.013	2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2.0
KO Drum to Reducer	S-1015	N-1020	N-1010	20"	20	19.250	0.012	19	3	67.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	86.4
KO Drum	S-1025	N-1030	N-1020	20"	20	19.250	0.012	0	0	0.0	0	0.0	1	66.8	0	0.0	0	0.0	0	0.0	66.8
V-1917 Tie In to KO Drum	S-1035	N-1040	N-1030	20"	20	19.250	0.012	508	3	67.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	575.4
V-1912 to V-1917 Tie In	S-1045	N-1050	N-1040	20"	20	19.250	0.012	25	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	25.0
Sulfatreat to V-1912 Tie In	S-1055	N-1060	N-1050	20"	20	19.250	0.012	65	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	4.8	69.8
Compressor Sub to Sulfatreat Tie In	S-1065	N-1070	N-1060	20"	20	19.250	0.012	25	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	25.0
Common Compressor Subheader @1	S-1075	N-2000	N-1070	12"	STD	12.000	0.013	23	2	28.0	0	0.0	0	0.0	0	0.0	1	60.0	1	3.0	114.0
West Compressor Subheader #1	S-2005	N-2010	N-2000	12"	STD	12.000	0.013	52	0	0.0	0	0.0	0	0.0	0	0.0	1	60.0	0	0.0	112.0
West Compressor Subheader #2	S-2035	N-2040	N-2010	12"	STD	12.000	0.013	60	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	80.0
C-1052 Subheader #1	S-2045	N-2050	N-2040	8"	40	7.981	0.014	28	0	0.0	2	10.6	0	0.0	0	0.0	1	39.9	1	2.0	80.5
C-1052 Subheader #2	S-2055	N-2060	N-2050	8"	40	7.981	0.014	1	0	0.0	2	10.6	0	0.0	1	13.3	0	0.0	1	2.0	26.9
PSV-1052E to Subheader 2"	S-2063	N-2065	N-2060	2"	80	1.939	0.019	4	4	9.0	0	0.0	0	0.0	1	3.2	0	0.0	0	0.0	16.3
PSV-1052E to Subheader 1"	**S-2068**	**N-2070**	**N-2065**	**1"**	**80**	**0.957**	**0.023**	**1.5**	**2**	**2.2**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**1**	**4.8**	**0**	**0.0**	**8.5**
C-1052 Subheader #3	S-2075	N-2080	N-2060	8"	40	7.981	0.014	17	1	9.3	2	10.6	0	0.0	0	0.0	0	0.0	0	0.0	37.0
PSV-1052B to Subheader	**S-2085**	**N-2090**	**N-2080**	**4"**	**40**	**4.026**	**0.017**	**1.5**	**2**	**9.4**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**1**	**20.1**	**0**	**0.0**	**31.0**
C-1052 Subheader #4	S-2095	N-2100	N-2080	8"	40	7.981	0.014	5	0	0.0	0	0.0	0	0.0	1	13.3	0	0.0	0	0.0	18.3
PSV-1052A to Subheader	**S-2105**	**N-2110**	**N-2100**	**3"**	**40**	**3.068**	**0.018**	**6**	**1**	**3.6**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**9.6**
C-1052 Subheader #5	S-2115	N-2120	N-2050	8"	40	7.981	0.014	2	0	0.0	0	0.0	0	0.0	0	0.0	1	39.9	0	0.0	41.9
C-1052 Subheader #6	S-2125	N-2130	N-2120	6"	40	6.065	0.015	19	1	7.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	26.1
PSV-1052 NEW to Subheader	**S-2135**	**N-2140**	**N-2130**	**3"**	**40**	**3.068**	**0.018**	**4**	**1**	**3.6**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**1**	**15.3**	**0**	**0.0**	**22.9**
PSV-1052C to Subheader	**S-2145**	**N-2150**	**N-2130**	**6"**	**40**	**6.065**	**0.015**	**38**	**2**	**14.2**	**0**	**0.0**	**0**	**0.0**	**1**	**10.1**	**0**	**0.0**	**0**	**0.0**	**62.3**
West Compressor Subheader #2	S-2155	N-2160	N-2040	12"	STD	12.000	0.013	60	0	0.0	0	0.0	0	0.0	1	20.0	0	0.0	0	0.0	80.0
C-1051 Subheader #1	S-2165	N-2170	N-2160	8"	40	7.981	0.014	26	1	9.3	2	10.6	0	0.0	0	0.0	1	39.9	1	2.0	87.9
C-1051 Subheader #2	S-2175	N-2180	N-2170	8"	40	7.981	0.014	7	1	9.3	2	10.6	0	0.0	1	13.3	0	0.0	0	0.0	40.3
PSV-1051E to Subheader 2"	S-2185	N-2190	N-2180	2"	80	1.939	0.019	3	2	4.5	2	2.6	0	0.0	1	3.2	0	0.0	0	0.0	13.3
PSV-1051E to Subheader 1"	**S-2195**	**N-2200**	**N-2190**	**1"**	**80**	**0.957**	**0.023**	**1**	**2**	**2.2**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**1**	**4.8**	**0**	**0.0**	**8.0**
C-1051 Subheader #3	S-2205	N-2210	N-2180	8"	40	7.981	0.014	10	0	0.0	2	10.6	0	0.0	0	0.0	0	0.0	0	0.0	20.6
PSV-1051B to Subheader	**S-2215**	**N-2220**	**N-2210**	**4"**	**40**	**4.026**	**0.017**	**1.5**	**2**	**9.4**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**1**	**20.1**	**0**	**0.0**	**31.0**
C-1051 Subheader #4	S-2225	N-2230	N-2210	8"	40	7.981	0.014	5	0	0.0	0	0.0	0	0.0	1	13.3	0	0.0	0	0.0	18.3
PSV-1051A to Subheader	**S-2235**	**N-2240**	**N-2230**	**3"**	**40**	**3.068**	**0.018**	**6**	**1**	**3.6**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**9.6**
C-1051 Subheader #5	S-2245	N-2250	N-2170	8"	40	7.981	0.014	2	0	0.0	0	0.0	0	0.0	0	0.0	1	39.9	0	0.0	41.9
C-1051 Subheader #6	S-2255	N-2260	N-2250	6"	40	6.065	0.015	19	1	7.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	26.1
PSV-1051 NEW to Subheader	**S-2265**	**N-2270**	**N-2260**	**3"**	**40**	**3.068**	**0.018**	**4**	**1**	**3.6**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**1**	**15.3**	**0**	**0.0**	**22.9**
PSV-1051C to Subheader	**S-2275**	**N-2280**	**N-2260**	**6"**	**40**	**6.065**	**0.015**	**38**	**2**	**14.2**	**0**	**0.0**	**0**	**0.0**	**1**	**10.1**	**0**	**0.0**	**0**	**0.0**	**62.3**

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #1 - C-1051 and C-1052
Flare Knockout Drum Evaluation

Inputs		
Density (Liquid)	40.00	lb/ft^3
Total Liquid In Flow	0	BPD
Low Liquid Level	7%	
Normal Liquid Level	14%	
High Liquid Level	30%	
Minimum Droplet Size	147	microns
Vessel Inner Diameter	6	ft
Selected Vessel Length	20	ft
Results from Hydraulic Evaluation		
Vapor Flowrate	7.03	MMSCFD
Operating Temperature	499.40	F
Operating Pressure	2.15	psig
Atmospheric Pressure	14.7	psia
MW (Vapor)	49.65	
Viscosity (Vapor)	0.01	cp
Density (Vapor)	0.082	lb/ft^3
Mass Flowrate	10.7	lb/s
Volumetric Flowrate	130.0	ft^3/sec
Calculate Terminal Settling Velocity		
Minimum Droplet Size	0.000482	ft
c'(Re)^2	347.5	
Drag Coefficient C'	4.33	
Terminal Settling Velocity	1.53	ft/s
Calculate Vessel Nozzle Separation Based on Low Level		
Full Area	28.3	ft^2
Required Fall Distance	5.6	ft
Required Residence Time	3.7	sec
Gas Velocity	4.60	ft/sec
Min. Nozzle Separation	16.8	ft
Calculate Vessel Nozzle Separation Based on Normal Level		
Level	0.8	ft
Required Fall Distance	5.2	ft
Required Residence Time	3.4	sec
α	43.9	degrees
x	2.1	ft
Circular Area	21.4	ft^2
Triangle Area	4.5	ft^2
Cross-Sectional Area	25.9	ft^2
Gas Velocity	5.02	ft/sec
Min. Nozzle Separation	17.0	ft
Calculate Vessel Nozzle Separation Based on High Level		
Level	1.8	ft
Required Fall Distance	4.2	ft
Required Residence Time	2.8	sec
α	66.4	degrees
x	2.7	ft
Circular Area	17.8	ft^2
Triangle Area	3.3	ft^2
Cross-Sectional Area	21.1	ft^2
Gas Velocity	6.15	ft/sec
Min. Nozzle Separation	16.9	ft

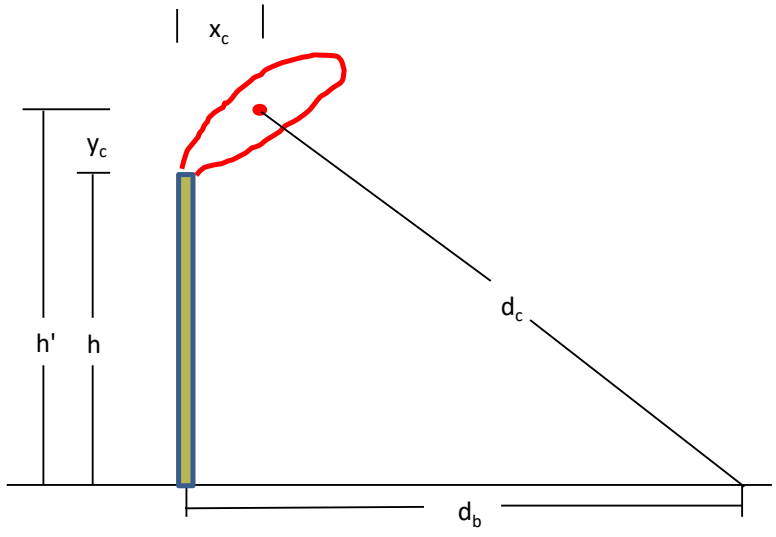
Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #1 - C-1051 and C-1052
Flare Tip Radiation and Exit Velocity

Inputs

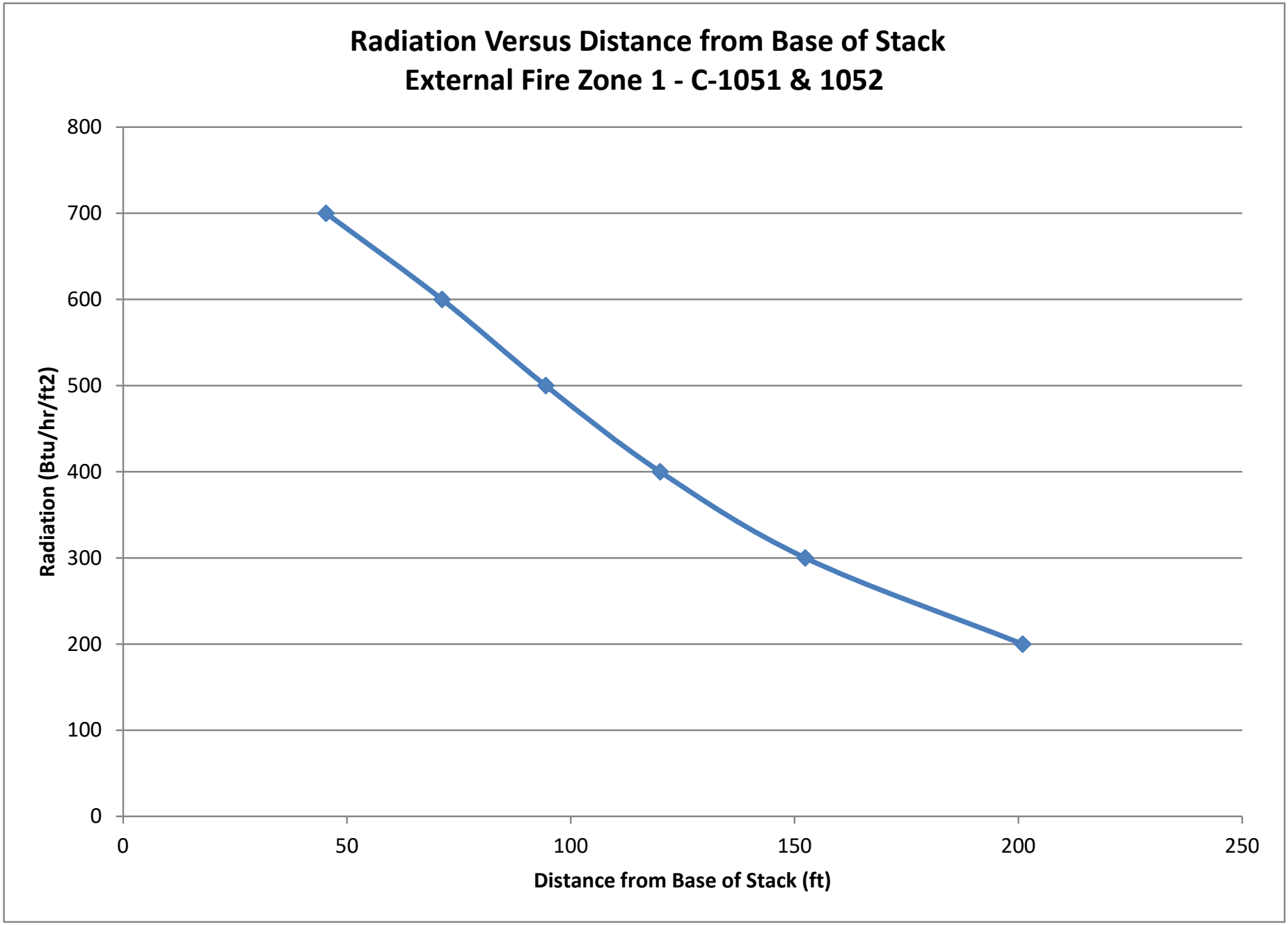
Atmsopheric Pressure	P_{atm}	14.7	psia
Mass Flowrate	q_m	38,319	lb/hr
Temperature	T_j	499	F
Molecular Weight	M_j	49.65	lb/lbmole
Compressibility	Z_j	0.99	
Heat of Combustion	LHV	19,318	Btu/lb
Flare Inner Diameter	d_j	1.17	ft
Flare Height	h	100	ft
Fraction Heat Radiated	F	0.16	
Wind Speed	u_j	20	mph
Ambient Temperature	T_∞	60	F
Horizontal Distance to Flame Center	x_c	15	ft
Vertical Distance to Flame Center	y_c	12	ft

Outputs

Exit Mach Number	Ma_2	0.14	
Isothermal Sonic Velocity	u_s	980.3	ft/sec
Exit Velocity	u_j	139.8	ft/sec
Mixture LEL	C_L	3.34	vol %
Wind Speed	u_j	29.3	ft/sec
LEL Concentration Parameter	C_L-	0.273	
Jet and Wind Thrust	d_jR	28.8	
Heat Released	Q	740	MMBtu/hr
Flame Center Height	h'	112	ft



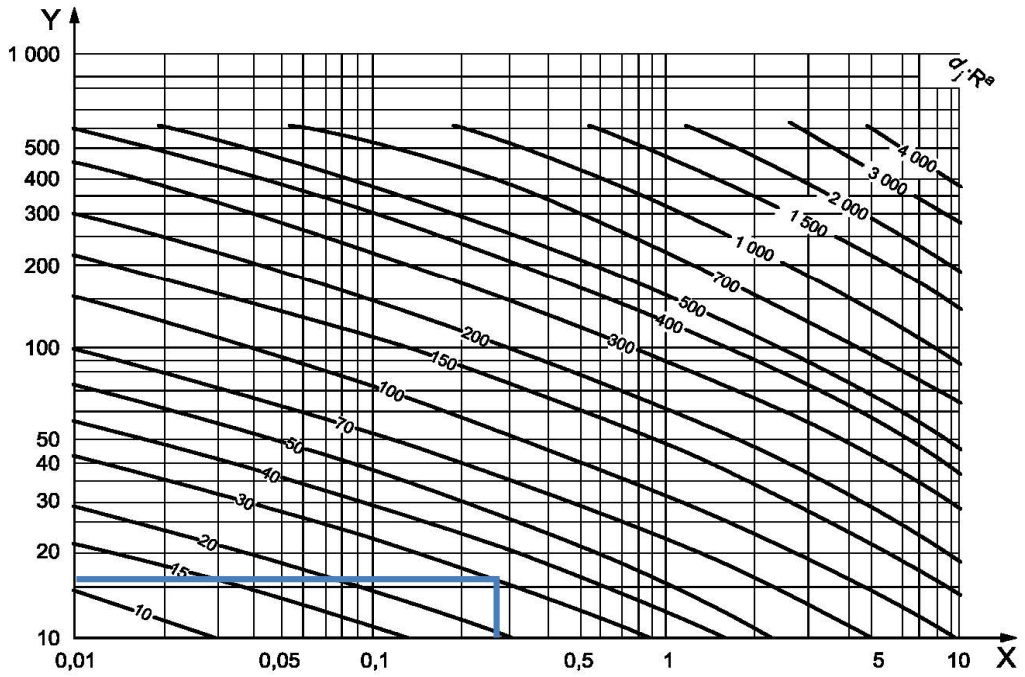
Radiation Level	Distance from Base d_b (ft)	Distance from Center d_c (ft)
200	201	217
300	152	177
400	120	154
500	94	137
600	71	125
700	45	116
800	N/A	109
900	N/A	102
1,000	N/A	97
1,100	N/A	93
1,200	N/A	89
1,300	N/A	85
1,400	N/A	82
1,500	N/A	79
1,600	N/A	77
1,700	N/A	74
1,800	N/A	72
1,900	N/A	70
2,000	N/A	69
2,100	N/A	67
2,200	N/A	65
2,300	N/A	64
2,350	N/A	63
2,450	N/A	62
2,550	N/A	61


Radiation Versus Distance from Base of Stack
External Fire Zone 1 - C-1051 & 1052
800
700
600
500
400
300
200
100
0
Radiation (Btu/hr/ft2)
0
50
100
150
200
250
Distance from Base of Stack (ft)

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #1 - C-1051 and C-1052
Flare Gas LEL Calculation

Component	LEL (Vol %)	Gross Heating Value (Btu/scf)	Net Heating Value (Btu/scf)	MW	Mole Fraction	LEL Contribution (%)	HHV Contribution (Btu/scf)	LHV Contribution (Btu/scf)
Hydrogen Sulfide	4.3	1,573.4	1,450.6	34.08	0.0002	0.00082	0.3	0.3
Nitrogen	100.0	-	-	28.01	0.0014	0.14315	0.0	0.0
Methane	5.0	1,010.0	909.4	16.04	0.3979	1.98964	401.9	361.9
Carbon Dioxide	100.0	-	-	44.01	0.0020	0.19742	0.0	0.0
Ethane	3.0	1,769.7	1,618.7	30.07	0.1212	0.36357	214.5	196.2
Propane	2.1	2,516.2	2,314.9	44.10	0.0878	0.18437	220.9	203.2
Butane	1.6	3,262.4	3,010.8	58.12	0.0550	0.08801	179.4	165.6
Isobutane	1.6	3,252.0	3,000.4	58.12	0.0197	0.03159	64.2	59.2
Pentane	1.4	4,008.7	3,706.9	72.15	0.0315	0.04403	126.1	116.6
Isopentane	1.3	4,000.9	3,699.0	72.15	0.0223	0.02903	89.3	82.6
Hexane	1.1	4,756.0	4,403.8	86.18	0.0198	0.02175	94.1	87.1
Cyclohexane	1.3	4,443.5	4,144.6	84.16	0.0169	0.02195	75.0	70.0
Heptane	1.1	5,502.5	5,100.0	100.20	0.0099	0.01088	54.4	50.4
Octane	1.0	6,248.9	5,796.0	114.23	0.1010	0.10098	631.0	585.3
Benzene	1.2	3,741.9	3,590.9	78.11	0.0107	0.01288	40.2	38.6
Ethylbenzene	1.0	5,222.0	4,970.4	106.17	0.1027	0.10270	536.3	510.4
					1.0000	3.34276	2,728	2,527

Mixture MW	**49.65**	**lb/lbmole**
Mixture LEL	**3.34**	**Vol %**
Mixture HHV	**2,728**	**Btu/scf**
Mixture HHV	**20,849**	**Btu/lbm**
Mixture LHV	**2,527**	**Btu/scf**
Mixture LHV	**19,318**	**Btu/lbm**



Key

X $\overline{C_L}$, the lower-explosive-limit concentration parameter for the flare gas, see Equation (C.7)

Y y_c, vertical distance from the stack to flame centre, expressed in feet

[a] $(d_j \cdot R)$ is the parameter for jet thrust and wind thrust, see Equation (C.8).

Figure C.5 — Flame centre for flares and ignited vents — Vertical distance, y_c (USC units)

C.3.4 Calculation of the distance from the flame centre to the object or point being considered

The design basis for this calculation is as follows: The fraction of heat radiated, F, is 0,3. The heat liberated (see C.2.3), Q, is $6{,}3 \times 10^6$ kW ($2{,}15 \times 10^{10}$ Btu/h). Say the flare stack design must limit the maximum allowable radiation (see 6.4.2.3), K, is 9,5 kW/m^2 (3 000 Btu/h·ft^2).

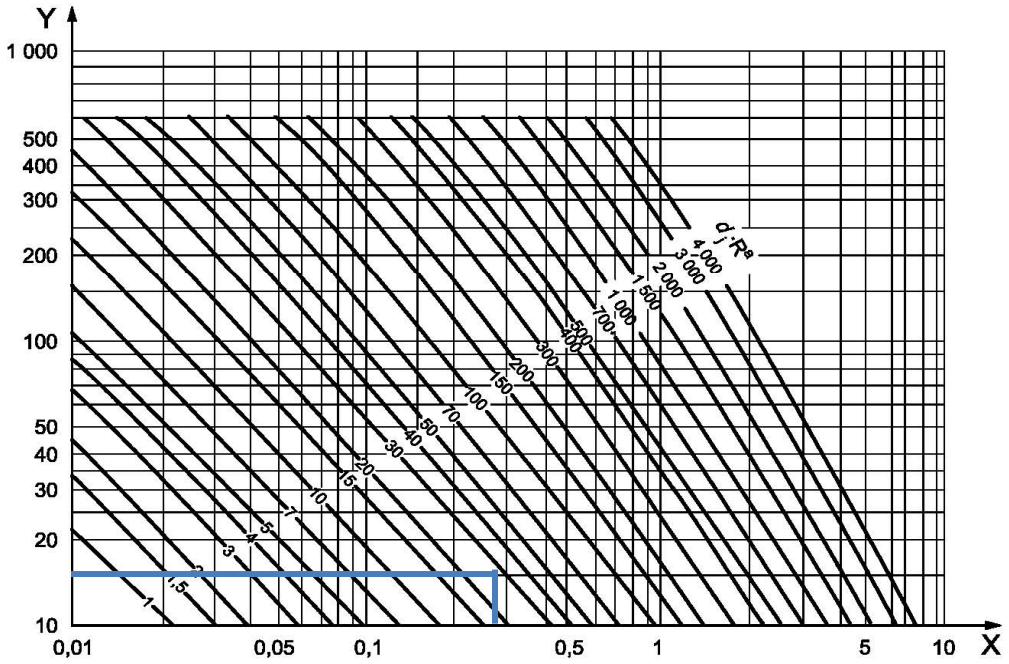
In Equation (24), the value of τ should be assumed to be 1,0 (see C.3.6.3 and C.3.6.4). The distance from the flame centre to the object or point being considered (that is, the distance to the limit of the radiant heat intensity, such as grade level, an equipment platform, or a plant boundary), D, is then calculated as follows:

$$D = \sqrt{\frac{\tau \cdot F \cdot Q}{4\pi \cdot K}} \tag{24}$$

In SI units:

$$D = \sqrt{\frac{1{,}0 \times 0{,}3 \times 6{,}3 \times 10^6}{4\pi \times 9{,}5}} = 126 \text{ m}$$

API Standard 521 / ISO 23251



Key

X $\overline{C_L}$, the lower-explosive-limit concentration parameter for the flare gas, see Equation (C.7)

Y x_c, horizontal distance from the stack to flame centre, expressed in feet

[a] $(d_j \cdot R)$ is the parameter for jet thrust and wind thrust, see Equation (C.8).

Figure C.3 — Flame centre for flares and ignited vents — Horizontal distance, x_c (USC units)

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9410 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03A	MAWP:	250 psig
Description:	C-1051 1st Stage Suction Scrubber	MAWT:	150 F

Scenario Description:

The scrubber may contain hydrocarbon liquids that condense out of the inlet stream. As such, overpressure could occur in the event of an external fire due to vaporization of the liquid. As the simulation predicts liquid drop out at the facility inlet, the hydrocarbon liquid composition was determined by dropping the inlet temperature to 70 F at which point a small amount of liquid hydrocarbon drops out. The liquid level was based on the LSHH location which is 19" or 19%.

Scenario Calculation Results:

Required Rate:	8910	lb/hr	Device Choke Pressure:	205.8	psig
Actual Capacity:	46052.9	lb/hr	Outlet Temperature:	455.4	F
Required Area:	0.249	in2	Outlet Mass Quality:	1.000	
Actual Area:	1.287	in2	Outlet Density:	0.133	lb/ft3
Relief Pressure:	326.7	psig	Outlet Ideal Cp/Cv:	1.042	
Relief Temperature:	497.3	F	Outlet Viscosity:	0.011	cP
Relief MW:	89.34		Inlet Non-Recoverble dP:	6.3	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	2.3	% Set
Relief Density:	4.53	lb/ft3	Built-Up Back Pressure:	64.5	psig
Relief SG:	3.081		Built-Up Back P % Set:	23.9	% Set
Relief Z:	0.66		Total Back Pressure:	64.5	psig
Relief Ideal Cp/Cv:	1.04		Total Back P % Set:	23.9	% Set
Relief Viscosity:	0.011	cP			

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9410 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03A	MAWP:	250 psig
Description:	C-1051 1st Stage Suction Scrubber	MAWT:	150 F

Scenario Input Data:

Length:	100	in
Diameter:	38	in
Orientation:	Vertical	
Head Type:	2:1 Ellipsoidal	
Level Basis:	LSHH-1500	
Additional Wetted Area:	0	ft2
Level:	19%	
Bottom Elevation:	2	ft
Area Exponent:	0.82	
Adequate Drainage	☐	
Insulation Factor:	1	
Start Mass % Vapor:	0.00%	
Finish Mass % Vapor:	5.00%	
Remove Sensible Heat:	☑	
Correct for Densities:	☐	
Set Pressure:	270	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0	psig
Use Thermodynamics:	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.975	
Nozzle Sizing:	API Numerical Integration Vapor	
Outlet Pipe Sizing:	Isothermal	

Notes:

Scenario Output Data:

Wetted Area:	26.6	ft2
Fire Heat Input:	0.51	MMBtu/hr
Total Heat/lb Vaporized:	254.0	Btu/lb
Sensible Heat/lb Vaporized:	196.9	Btu/lb
Latent Heat:	57.1	Btu/lb
Initial Relief Temperature:	485.3	F
Temp. at Start Quality:	485.3	F
Cp at Start Quality:	0.811	Btu/lb/F
Cp at Final Quality:	0.829	Btu/lb/F
Liquid Density:	31.49	lb/ft3
Required Mass Rate:	8910.0	lb/hr
Required Std. Vol. Rate:	0.91	MMSCFD
Required Air Rate:	90133.8	scfh air
Relief Mass Flux:	1430.7	lb/sec/ft2

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9410 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03A	MAWP:	250 psig
Description:	C-1051 1st Stage Suction Scrubber	MAWT:	150 F

Liquid Stream Description: **Valley Wells Compressor Scrubber Liquids**

Relief Stream Description: **V-9410 Fire HC Vapor**

Component	Liquid Stream Mole Fraction	Relief Stream Mole Fraction
hydrogen sulfide	0.0000	0.0000
nitrogen	0.0000	0.0000
methane	0.0100	0.0516
carbon dioxide	0.0001	0.0005
ethane	0.0114	0.0430
propane	0.0169	0.0506
butane	0.0231	0.0522
isobutane	0.0067	0.0162
ipentane	0.0238	0.0433
isopentane	0.0158	0.0288
hexane	0.0286	0.0382
cyclohexane	0.0316	0.0359
heptane	0.0233	0.0241
octane	0.3616	0.2889
benzene	0.0183	0.0222
ethylbenzene	0.4287	0.3045

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**V-9432 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03C	MAWP:	1450 psig
Description:	C-1051 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Description:

The 3rd Stage Discharge Bottle is free of iquid therefore overpressure could occur due to expansion of the vapor in the during an external fire. The required relief rate was based on the 3rd stage discharge PSHH setting of 1300 psig and 260 F with a relief pressure of 1742.4 psig.

Scenario Calculation Results:

Required Rate:	1428.4	lb/hr	Device Choke Pressure:	989.4	psig
Actual Capacity:	65863.4	lb/hr	Outlet Temperature:	393.8	F
Required Area:	0.019	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.865	in2	Outlet Density:	0.034	lb/ft3
Relief Pressure:	1742.4	psig	Outlet Ideal Cp/Cv:	1.2	
Relief Temperature:	435.0	F	Outlet Viscosity:	0.015	cP
Relief MW:	21.78		Inlet Non-Recoverble dP:	11.6	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.8	% Set
Relief Density:	4.13	lb/ft3	Built-Up Back Pressure:	159.3	psig
Relief SG:	0.751		Built-Up Back P % Set:	11.1	% Set
Relief Z:	0.97		Total Back Pressure:	159.3	psig
Relief Ideal Cp/Cv:	1.17		Total Back P % Set:	11.1	% Set
Relief Viscosity:	0.016	cP			

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**V-9432 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03C	MAWP:	1450 psig
Description:	C-1051 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Input Data:

Length:	74	in
Diameter:	20	in
Orientation:	Horizontal	
Head Type:	2:1 Ellipsoidal	
Additional Area:	0	ft2
Maximum Wall Temp.:	1100	F
Set Pressure:	1440	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0.0	psig
Operating Pressure:	1300	psig
Operating Temperature:	260	F
Thermodynamics Enabled:	☑	
Initial Relief T per Ideal Gas:	☐	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.818	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	

Scenario Output Data:

Exposed Area:	38	ft2
Required Mass Rate:	1428.4	lb/hr
Required Rate Std. Vol.:	0.60	MMSCFD
Required Air Rate:	28297.6	scfh air
Required Mass Flux:	3045.7	lb/sec/ft2

Notes:

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**V-9432 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03C	MAWP:	1450 psig
Description:	C-1051 3rd Stage Discharge Bottle	MAWT:	350 F

Relief Stream Composition:

Stream Description: Valley Wellls 3rd Suction Gas

Component	Mole Fraction
hydrogen sulfide	0.0003
nitrogen	0.0016
methane	0.7626
carbon dioxide	0.0027
ethane	0.1316
propane	0.0578
butane	0.0193
isobutane	0.0084
ipentane	0.0053
isopentane	0.0047
hexane	0.0015
cyclohexane	0.0010
heptane	0.0003
octane	0.0012
benzene	0.0007
ethylbenzene	0.0009

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9422 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03B	MAWP:	645 psig
Description:	C-1051 2nd Stage Discharge Bottle	MAWT:	350 F

Scenario Description:

In the event the 3rd Stage Suction Scrubber contains liquid hydrocarbon, overpressure could occur due to the vaporization of the liquid during an external fire. The required relief rate was based on the predicted hydrocarbon liquid composition at the relief pressure of 780.5 psig. The liquid level was based on the location of LSHH-1502 with is 19" or 22%. Note that hydrocarbon represents the worst case so the relief requirement is significantly less if water is only present.

Scenario Calculation Results:

Required Rate:	4627.5	lb/hr	Device Choke Pressure:	447.0	psig
Actual Capacity:	107056.1	lb/hr	Outlet Temperature:	226.6	F
Required Area:	0.090	in2	Outlet Mass Quality:	1.000	
Actual Area:	2.074	in2	Outlet Density:	0.068	lb/ft3
Relief Pressure:	780.5	psig	Outlet Ideal Cp/Cv:	1.128	
Relief Temperature:	284.0	F	Outlet Viscosity:	0.011	cP
Relief MW:	34.85		Inlet Non-Recoverble dP:	4.6	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.7	% Set
Relief Density:	4.32	lb/ft3	Built-Up Back Pressure:	96.5	psig
Relief SG:	1.202		Built-Up Back P % Set:	15.0	% Set
Relief Z:	0.80		Total Back Pressure:	96.5	psig
Relief Ideal Cp/Cv:	1.12		Total Back P % Set:	15.0	% Set
Relief Viscosity:	0.012	cP			

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9422 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03B	MAWP:	645 psig
Description:	C-1051 2nd Stage Discharge Bottle	MAWT:	350 F

Scenario Input Data:

Length:	86	in
Diameter:	24	in
Orientation:	Vertical	
Head Type:	2:1 Ellipsoidal	
Level Basis:	LSHH-1502	
Additional Wetted Area:	0	ft2
Level:	22%	
Bottom Elevation:	2	ft
Area Exponent:	0.82	
Adequate Drainage	☐	
Insulation Factor:	1	
Start Mass % Vapor:	0.00%	
Finish Mass % Vapor:	5.00%	
Remove Sensible Heat:	☑	
Correct for Densities:	☑	
Set Pressure:	645	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0	psig
Use Thermodynamics:	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.818	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	
Notes:		

Scenario Output Data:

Wetted Area:	14.2	ft2
Fire Heat Input:	0.3	MMBtu/hr
Total Heat/lb Vaporized:	1310.0	Btu/lb
Sensible Heat/lb Vaporized:	1251.8	Btu/lb
Latent Heat:	58.2	Btu/lb
Initial Relief Temperature:	184.1	F
Temp. at Start Quality:	184.2	F
Cp at Start Quality:	0.589	Btu/lb/F
Cp at Final Quality:	0.665	Btu/lb/F
Liquid Density:	37.24	lb/ft3
Required Mass Rate:	4627.5	lb/hr
Required Std. Vol. Rate:	1.21	MMSCFD
Required Air Rate:	66076.5	scfh air
Relief Mass Flux:	2064.7	lb/sec/ft2

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9422 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03B	MAWP:	645 psig
Description:	C-1051 2nd Stage Discharge Bottle	MAWT:	350 F

Liquid Stream Description: **Valley Wells 3rd Scrubber Liquids**

Relief Stream Description: **V-9422 Fire HC Vapor**

Component	Liquid Stream Mole Fraction	Relief Stream Mole Fraction
hydrogen sulfide	0.0001	0.0002
nitrogen	0.0000	0.0000
methane	0.1422	0.4740
carbon dioxide	0.0011	0.0028
ethane	0.0935	0.1807
propane	0.0995	0.1263
butane	0.0872	0.0675
isobutane	0.0292	0.0258
ipentane	0.0574	0.0307
isopentane	0.0428	0.0229
hexane	0.0442	0.0132
cyclohexane	0.0395	0.0094
heptane	0.0206	0.0039
octane	0.1650	0.0201
benzene	0.0237	0.0063
ethylbenzene	0.1540	0.0161

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9412 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03A	MAWP:	275 psig
Description:	C-1051 1st Stage Discharge Bottle	MAWT:	350 F

Scenario Description:

In the event the 2nd Stage Suction Scrubber contains liquid hydrocarbon, overpressure could occur due to the vaporization of the liquid during an external fire. The required relief rate was based on the predicted hydrocarbon liquid composition at the relief pressure of 302.5 psig. The liquid level was based on the location of LSHH-1501 with is 19" or 22%. Note that hydrocarbon represents so the relief requirement is significantly less if water is only present.

Scenario Calculation Results:

Required Rate:	3870	lb/hr	Device Choke Pressure:	173.0	psig
Actual Capacity:	97031	lb/hr	Outlet Temperature:	349.9	F
Required Area:	0.163	in2	Outlet Mass Quality:	1.000	
Actual Area:	4.080	in2	Outlet Density:	0.094	lb/ft3
Relief Pressure:	302.5	psig	Outlet Ideal Cp/Cv:	1.071	
Relief Temperature:	377.3	F	Outlet Viscosity:	0.011	cP
Relief MW:	56.56		Inlet Non-Recoverble dP:	2.3	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.9	% Set
Relief Density:	2.38	lb/ft3	Built-Up Back Pressure:	40.3	psig
Relief SG:	1.950		Built-Up Back P % Set:	16.1	% Set
Relief Z:	0.84		Total Back Pressure:	40.3	psig
Relief Ideal Cp/Cv:	1.07		Total Back P % Set:	16.1	% Set
Relief Viscosity:	0.012	cP			

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9412 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03A	MAWP:	275 psig
Description:	C-1051 1st Stage Discharge Bottle	MAWT:	350 F

Scenario Input Data:

Length:	88	in
Diameter:	26	in
Orientation:	Vertical	
Head Type:	2:1 Ellipsoidal	
Level Basis:	LSHH-1501	
Additional Wetted Area:	0	ft2
Level:	22%	
Bottom Elevation:	2	ft
Area Exponent:	0.82	
Adequate Drainage	☐	
Insulation Factor:	1	
Start Mass % Vapor:	0.00%	
Finish Mass % Vapor:	5.00%	
Remove Sensible Heat:	☑	
Correct for Densities:	☑	
Set Pressure:	250	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0	psig
Use Thermodynamics:	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.818	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	
Notes:		

Scenario Output Data:

Wetted Area:	16.1	ft2
Fire Heat Input:	0.34	MMBtu/hr
Total Heat/lb Vaporized:	1550.0	Btu/lb
Sensible Heat/lb Vaporized:	1468.2	Btu/lb
Latent Heat:	81.8	Btu/lb
Initial Relief Temperature:	260.4	F
Temp. at Start Quality:	260.6	F
Cp at Start Quality:	0.586	Btu/lb/F
Cp at Final Quality:	0.672	Btu/lb/F
Liquid Density:	40.50	lb/ft3
Required Mass Rate:	3870.0	lb/hr
Required Std. Vol. Rate:	0.62	MMSCFD
Required Air Rate:	46016.3	scfh air
Relief Mass Flux:	951.3	lb/sec/ft2

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9412 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03A	MAWP:	275 psig
Description:	C-1051 1st Stage Discharge Bottle	MAWT:	350 F

Liquid Stream Description: **Valley Wellls 2nd Scrubber Liquids**

Relief Stream Description: **V-9420 Fire HC Vapor**

Component	Liquid Stream Mole Fraction	Relief Stream Mole Fraction
hydrogen sulfide	0.0001	0.0004
nitrogen	0.0000	0.0000
methane	0.0400	0.2484
carbon dioxide	0.0004	0.0021
ethane	0.0331	0.1377
propane	0.0404	0.1207
butane	0.0433	0.0846
isobutane	0.0136	0.0296
ipentane	0.0356	0.0496
isopentane	0.0251	0.0350
hexane	0.0346	0.0288
cyclohexane	0.0364	0.0237
heptane	0.0234	0.0127
octane	0.3061	0.1083
benzene	0.0212	0.0153
ethylbenzene	0.3468	0.1031

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**F-3052 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03F	MAWP:	270 psig
Description:	C-1051 Fuel Gas Filter	MAWT:	150 F

Scenario Description:

As no liquids are expected in the Fuel Gas Filter, an external fire could result in overpressure due expansion of the vapor. The normal fuel gas supply pressure is 135 psig with a proposed PAHH-2022 set point of 150 psig on the 2nd Stage Fuel Gas Scrubber (V-2020). The required relief rate was therefore conservatively based on operating conditions of 150 psig and 60 F with the relief pressure of 211.75 psig. The normal Whistler Fuel Gas composition was used.

Scenario Calculation Results:

Required Rate:	323.7	lb/hr	Device Choke Pressure:	110.8	psig
Actual Capacity:	2035.3	lb/hr	Outlet Temperature:	236.5	F
Required Area:	0.034	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.212	in2	Outlet Density:	0.032	lb/ft3
Relief Pressure:	211.8	psig	Outlet Ideal Cp/Cv:	1.3	
Relief Temperature:	244.0	F	Outlet Viscosity:	0.014	cP
Relief MW:	16.67		Inlet Non-Recoverble dP:	1.1	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.6	% Set
Relief Density:	0.51	lb/ft3	Built-Up Back Pressure:	42.5	psig
Relief SG:	0.575		Built-Up Back P % Set:	24.3	% Set
Relief Z:	0.99		Total Back Pressure:	42.5	psig
Relief Ideal Cp/Cv:	1.26		Total Back P % Set:	24.3	% Set
Relief Viscosity:	0.014	cP			

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**F-3052 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03F	MAWP:	270 psig
Description:	C-1051 Fuel Gas Filter	MAWT:	150 F

Scenario Input Data:

Length:	75.375	in
Diameter:	8.625	in
Orientation:	Vertical	
Head Type:	2:1 Ellipsoidal	
Additional Area:	0	ft2
Maximum Wall Temp.:	1100	F
Set Pressure:	175	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0.0	psig
Operating Pressure:	150	psig
Operating Temperature:	60	F
Thermodynamics Enabled:	☑	
Initial Relief T per Ideal Gas:	☐	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.800	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	

Scenario Output Data:

Exposed Area:	15	ft2
Required Mass Rate:	323.7	lb/hr
Required Rate Std. Vol.:	0.18	MMSCFD
Required Air Rate:	6500.4	scfh air
Required Mass Flux:	384.0	lb/sec/ft2

Notes:

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**F-3052 (C-1051)**	Type:	Pressure Vessel
Drawing:	D-2415-F-03F	MAWP:	270 psig
Description:	C-1051 Fuel Gas Filter	MAWT:	150 F

Relief Stream Composition:

Stream Description: Valley Wells Whistler Fuel Gas

Component	Mole Fraction
carbon dioxide	0.0010
nitrogen	0.0231
methane	0.9535
ethane	0.0220
propane	0.0004
isobutane	0.0000
butane	0.0000
isopentane	
pentane	
hexane	
heptane	
octane	
nonane	
decane	
methanol	
water	

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9410 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04A	MAWP:	270 psig
Description:	C-1052 1st Stage Suction Scrubber	MAWT:	150 F

Scenario Description:

The scrubber may contain hydrocarbon liquids that condense out of the inlet stream. As such, overpressure could occur in the event of an external fire due to vaporization of the liquid. As the simulation predicts liquid drop out at the facility inlet, the hydrocarbon liquid composition was determined by dropping the inlet temperature to 70 F at which point a small amount of liquid hydrocarbon drops out. The liquid level was based on the LSHH location which is 19" or 19%.

Scenario Calculation Results:

Required Rate:	8910	lb/hr	Device Choke Pressure:	205.8	psig
Actual Capacity:	46052.9	lb/hr	Outlet Temperature:	455.4	F
Required Area:	0.249	in2	Outlet Mass Quality:	1.000	
Actual Area:	1.287	in2	Outlet Density:	0.133	lb/ft3
Relief Pressure:	326.7	psig	Outlet Ideal Cp/Cv:	1.042	
Relief Temperature:	497.3	F	Outlet Viscosity:	0.011	cP
Relief MW:	89.34		Inlet Non-Recoverble dP:	6.3	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	2.3	% Set
Relief Density:	4.53	lb/ft3	Built-Up Back Pressure:	64.5	psig
Relief SG:	3.081		Built-Up Back P % Set:	23.9	% Set
Relief Z:	0.66		Total Back Pressure:	64.5	psig
Relief Ideal Cp/Cv:	1.04		Total Back P % Set:	23.9	% Set
Relief Viscosity:	0.011	cP			

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9410 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04A	MAWP:	270 psig
Description:	C-1052 1st Stage Suction Scrubber	MAWT:	150 F

Scenario Input Data:

Length:	100	in
Diameter:	38	in
Orientation:	Vertical	
Head Type:	2:1 Ellipsoidal	
Level Basis:	LSHH-1500	
Additional Wetted Area:	0	ft2
Level:	19%	
Bottom Elevation:	2	ft
Area Exponent:	0.82	
Adequate Drainage	☐	
Insulation Factor:	1	
Start Mass % Vapor:	0.00%	
Finish Mass % Vapor:	5.00%	
Remove Sensible Heat:	☑	
Correct for Densities:	☐	
Set Pressure:	270	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0	psig
Use Thermodynamics:	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.975	
Nozzle Sizing:	API Numerical Integration Vapor	
Outlet Pipe Sizing:	Isothermal	

Notes:

Scenario Output Data:

Wetted Area:	26.6	ft2
Fire Heat Input:	0.51	MMBtu/hr
Total Heat/lb Vaporized:	254.0	Btu/lb
Sensible Heat/lb Vaporized:	196.9	Btu/lb
Latent Heat:	57.1	Btu/lb
Initial Relief Temperature:	485.3	F
Temp. at Start Quality:	485.3	F
Cp at Start Quality:	0.811	Btu/lb/F
Cp at Final Quality:	0.829	Btu/lb/F
Liquid Density:	31.49	lb/ft3
Required Mass Rate:	8910.0	lb/hr
Required Std. Vol. Rate:	0.91	MMSCFD
Required Air Rate:	90133.8	scfh air
Relief Mass Flux:	1430.7	lb/sec/ft2

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9410 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04A	MAWP:	270 psig
Description:	C-1052 1st Stage Suction Scrubber	MAWT:	150 F

Liquid Stream Description: **Valley Wells Compressor Scrubber Liquids**

Relief Stream Description: **V-9410 Fire HC Vapor**

Component	Liquid Stream Mole Fraction	Relief Stream Mole Fraction
hydrogen sulfide	0.0000	0.0000
nitrogen	0.0000	0.0000
methane	0.0100	0.0516
carbon dioxide	0.0001	0.0005
ethane	0.0114	0.0430
propane	0.0169	0.0506
butane	0.0231	0.0522
isobutane	0.0067	0.0162
ipentane	0.0238	0.0433
isopentane	0.0158	0.0288
hexane	0.0286	0.0382
cyclohexane	0.0316	0.0359
heptane	0.0233	0.0241
octane	0.3616	0.2889
benzene	0.0183	0.0222
ethylbenzene	0.4287	0.3045

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**V-9432 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04C	MAWP:	1450 psig
Description:	C-1052 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Description:

The 3rd Stage Discharge Bottle is free of iquid therefore overpressure could occur due to expansion of the vapor in the during an external fire. The required relief rate was based on the 3rd stage discharge PSHH setting of 1300 psig and 260 F with a relief pressure of 1742.4 psig.

Scenario Calculation Results:

Required Rate:	1428.4	lb/hr	Device Choke Pressure:	989.4	psig
Actual Capacity:	65863.4	lb/hr	Outlet Temperature:	393.8	F
Required Area:	0.019	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.865	in2	Outlet Density:	0.034	lb/ft3
Relief Pressure:	1742.4	psig	Outlet Ideal Cp/Cv:	1.2	
Relief Temperature:	435.0	F	Outlet Viscosity:	0.015	cP
Relief MW:	21.78		Inlet Non-Recoverble dP:	11.6	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.8	% Set
Relief Density:	4.13	lb/ft3	Built-Up Back Pressure:	159.3	psig
Relief SG:	0.751		Built-Up Back P % Set:	11.1	% Set
Relief Z:	0.97		Total Back Pressure:	159.3	psig
Relief Ideal Cp/Cv:	1.17		Total Back P % Set:	11.1	% Set
Relief Viscosity:	0.016	cP			

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**V-9432 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04C	MAWP:	1450 psig
Description:	C-1052 3rd Stage Discharge Bottle	MAWT:	350 F

Scenario Input Data:

Length:	74	in
Diameter:	20	in
Orientation:	Horizontal	
Head Type:	2:1 Ellipsoidal	
Additional Area:	0	ft2
Maximum Wall Temp.:	1100	F
Set Pressure:	1440	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0.0	psig
Operating Pressure:	1300	psig
Operating Temperature:	260	F
Thermodynamics Enabled:	☑	
Initial Relief T per Ideal Gas:	☐	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.818	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	

Scenario Output Data:

Exposed Area:	38	ft2
Required Mass Rate:	1428.4	lb/hr
Required Rate Std. Vol.:	0.60	MMSCFD
Required Air Rate:	28297.6	scfh air
Required Mass Flux:	3045.7	lb/sec/ft2

Notes:

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**V-9432 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04C	MAWP:	1450 psig
Description:	C-1052 3rd Stage Discharge Bottle	MAWT:	350 F

Relief Stream Composition:

Stream Description: Valley Wellls 3rd Suction Gas

Component	Mole Fraction
hydrogen sulfide	0.0003
nitrogen	0.0016
methane	0.7626
carbon dioxide	0.0027
ethane	0.1316
propane	0.0578
butane	0.0193
isobutane	0.0084
ipentane	0.0053
isopentane	0.0047
hexane	0.0015
cyclohexane	0.0010
heptane	0.0003
octane	0.0012
benzene	0.0007
ethylbenzene	0.0009

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9422 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04B	MAWP:	645 psig
Description:	C-1052 2nd Stage Discharge Bottle	MAWT:	350 F

Scenario Description:

In the event the 3rd Stage Suction Scrubber contains liquid hydrocarbon, overpressure could occur due to the vaporization of the liquid during an external fire. The required relief rate was based on the predicted hydrocarbon liquid composition at the relief pressure of 780.5 psig. The liquid level was based on the location of LSHH-1502 with is 19" or 22%. Note that hydrocarbon represents the worst case so the relief requirement is significantly less if water is only present.

Scenario Calculation Results:

Required Rate:	4627.5	lb/hr	Device Choke Pressure:	447.0	psig
Actual Capacity:	107056.1	lb/hr	Outlet Temperature:	226.6	F
Required Area:	0.090	in2	Outlet Mass Quality:	1.000	
Actual Area:	2.074	in2	Outlet Density:	0.068	lb/ft3
Relief Pressure:	780.5	psig	Outlet Ideal Cp/Cv:	1.128	
Relief Temperature:	284.0	F	Outlet Viscosity:	0.011	cP
Relief MW:	34.85		Inlet Non-Recoverble dP:	4.6	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.7	% Set
Relief Density:	4.32	lb/ft3	Built-Up Back Pressure:	96.5	psig
Relief SG:	1.202		Built-Up Back P % Set:	15.0	% Set
Relief Z:	0.80		Total Back Pressure:	96.5	psig
Relief Ideal Cp/Cv:	1.12		Total Back P % Set:	15.0	% Set
Relief Viscosity:	0.012	cP			

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9422 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04B	MAWP:	645 psig
Description:	C-1052 2nd Stage Discharge Bottle	MAWT:	350 F

Scenario Input Data:

Length:	86	in
Diameter:	24	in
Orientation:	Vertical	
Head Type:	2:1 Ellipsoidal	
Level Basis:	LSHH-1502	
Additional Wetted Area:	0	ft2
Level:	22%	
Bottom Elevation:	2	ft
Area Exponent:	0.82	
Adequate Drainage	☐	
Insulation Factor:	1	
Start Mass % Vapor:	0.00%	
Finish Mass % Vapor:	5.00%	
Remove Sensible Heat:	☑	
Correct for Densities:	☑	
Set Pressure:	645	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0	psig
Use Thermodynamics:	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.818	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	

Notes:

Scenario Output Data:

Wetted Area:	14.2	ft2
Fire Heat Input:	0.3	MMBtu/hr
Total Heat/lb Vaporized:	1310.0	Btu/lb
Sensible Heat/lb Vaporized:	1251.8	Btu/lb
Latent Heat:	58.2	Btu/lb
Initial Relief Temperature:	184.1	F
Temp. at Start Quality:	184.2	F
Cp at Start Quality:	0.589	Btu/lb/F
Cp at Final Quality:	0.665	Btu/lb/F
Liquid Density:	37.24	lb/ft3
Required Mass Rate:	4627.5	lb/hr
Required Std. Vol. Rate:	1.21	MMSCFD
Required Air Rate:	66076.5	scfh air
Relief Mass Flux:	2064.7	lb/sec/ft2

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9422 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04B	MAWP:	645 psig
Description:	C-1052 2nd Stage Discharge Bottle	MAWT:	350 F

Liquid Stream Description: **Valley Wells 3rd Scrubber Liquids**

Relief Stream Description: **V-9422 Fire HC Vapor**

Component	Liquid Stream Mole Fraction	Relief Stream Mole Fraction
hydrogen sulfide	0.0001	0.0002
nitrogen	0.0000	0.0000
methane	0.1422	0.4740
carbon dioxide	0.0011	0.0028
ethane	0.0935	0.1807
propane	0.0995	0.1263
butane	0.0872	0.0675
isobutane	0.0292	0.0258
ipentane	0.0574	0.0307
isopentane	0.0428	0.0229
hexane	0.0442	0.0132
cyclohexane	0.0395	0.0094
heptane	0.0206	0.0039
octane	0.1650	0.0201
benzene	0.0237	0.0063
ethylbenzene	0.1540	0.0161

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9412 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04A	MAWP:	275 psig
Description:	C-1052 1st Stage Discharge Bottle	MAWT:	350 F

Scenario Description:

In the event the 2nd Stage Suction Scrubber contains liquid hydrocarbon, overpressure could occur due to the vaporization of the liquid during an external fire. The required relief rate was based on the predicted hydrocarbon liquid composition at the relief pressure of 302.5 psig. The liquid level was based on the location of LSHH-1501 with is 19" or 22%. Note that hydrocarbon represents so the relief requirement is significantly less if water is only present.

Scenario Calculation Results:

Required Rate:	3870	lb/hr	Device Choke Pressure:	173.0	psig
Actual Capacity:	97031	lb/hr	Outlet Temperature:	349.9	F
Required Area:	0.163	in2	Outlet Mass Quality:	1.000	
Actual Area:	4.080	in2	Outlet Density:	0.094	lb/ft3
Relief Pressure:	302.5	psig	Outlet Ideal Cp/Cv:	1.071	
Relief Temperature:	377.3	F	Outlet Viscosity:	0.011	cP
Relief MW:	56.56		Inlet Non-Recoverble dP:	2.3	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.9	% Set
Relief Density:	2.38	lb/ft3	Built-Up Back Pressure:	40.3	psig
Relief SG:	1.950		Built-Up Back P % Set:	16.1	% Set
Relief Z:	0.84		Total Back Pressure:	40.3	psig
Relief Ideal Cp/Cv:	1.07		Total Back P % Set:	16.1	% Set
Relief Viscosity:	0.012	cP			

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9412 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04A	MAWP:	275 psig
Description:	C-1052 1st Stage Discharge Bottle	MAWT:	350 F

Scenario Input Data:

Length:	88	in
Diameter:	26	in
Orientation:	Vertical	
Head Type:	2:1 Ellipsoidal	
Level Basis:	LSHH-1501	
Additional Wetted Area:	0	ft2
Level:	22%	
Bottom Elevation:	2	ft
Area Exponent:	0.82	
Adequate Drainage	☐	
Insulation Factor:	1	
Start Mass % Vapor:	0.00%	
Finish Mass % Vapor:	5.00%	
Remove Sensible Heat:	☑	
Correct for Densities:	☑	
Set Pressure:	250	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0	psig
Use Thermodynamics:	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.818	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	

Notes:

Scenario Output Data:

Wetted Area:	16.1	ft2
Fire Heat Input:	0.34	MMBtu/hr
Total Heat/lb Vaporized:	1550.0	Btu/lb
Sensible Heat/lb Vaporized:	1468.2	Btu/lb
Latent Heat:	81.8	Btu/lb
Initial Relief Temperature:	260.4	F
Temp. at Start Quality:	260.6	F
Cp at Start Quality:	0.586	Btu/lb/F
Cp at Final Quality:	0.672	Btu/lb/F
Liquid Density:	40.50	lb/ft3
Required Mass Rate:	3870.0	lb/hr
Required Std. Vol. Rate:	0.62	MMSCFD
Required Air Rate:	46016.3	scfh air
Relief Mass Flux:	951.3	lb/sec/ft2

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-9412 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04A	MAWP:	275 psig
Description:	C-1052 1st Stage Discharge Bottle	MAWT:	350 F

Liquid Stream Description: **Valley Wellls 2nd Scrubber Liquids**

Relief Stream Description: **V-9420 Fire HC Vapor**

Component	Liquid Stream Mole Fraction	Relief Stream Mole Fraction
hydrogen sulfide	0.0001	0.0004
nitrogen	0.0000	0.0000
methane	0.0400	0.2484
carbon dioxide	0.0004	0.0021
ethane	0.0331	0.1377
propane	0.0404	0.1207
butane	0.0433	0.0846
isobutane	0.0136	0.0296
ipentane	0.0356	0.0496
isopentane	0.0251	0.0350
hexane	0.0346	0.0288
cyclohexane	0.0364	0.0237
heptane	0.0234	0.0127
octane	0.3061	0.1083
benzene	0.0212	0.0153
ethylbenzene	0.3468	0.1031

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**F-3052 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04F	MAWP:	270 psig
Description:	C-1052 Fuel Gas Filter	MAWT:	150 F

Scenario Description:

As no liquids are expected in the Fuel Gas Filter, an external fire could result in overpressure due expansion of the vapor. The normal fuel gas supply pressure is 135 psig with a proposed PAHH-2022 set point of 150 psig on the 2nd Stage Fuel Gas Scrubber (V-2020). The required relief rate was therefore conservatively based on operating conditions of 150 psig and 60 F with the relief pressure of 211.75 psig. The normal Whistler Fuel Gas composition was used.

Scenario Calculation Results:

Required Rate:	323.7	lb/hr	Device Choke Pressure:	110.8	psig
Actual Capacity:	2035.3	lb/hr	Outlet Temperature:	236.5	F
Required Area:	0.034	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.212	in2	Outlet Density:	0.032	lb/ft3
Relief Pressure:	211.8	psig	Outlet Ideal Cp/Cv:	1.3	
Relief Temperature:	244.0	F	Outlet Viscosity:	0.014	cP
Relief MW:	16.67		Inlet Non-Recoverble dP:	1.1	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.6	% Set
Relief Density:	0.51	lb/ft3	Built-Up Back Pressure:	42.3	psig
Relief SG:	0.575		Built-Up Back P % Set:	24.2	% Set
Relief Z:	0.99		Total Back Pressure:	42.3	psig
Relief Ideal Cp/Cv:	1.26		Total Back P % Set:	24.2	% Set
Relief Viscosity:	0.014	cP			

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**F-3052 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04F	MAWP:	270 psig
Description:	C-1052 Fuel Gas Filter	MAWT:	150 F

Scenario Input Data:

Length:	75.375	in
Diameter:	8.625	in
Orientation:	Vertical	
Head Type:	2:1 Ellipsoidal	
Additional Area:	0	ft2
Maximum Wall Temp.:	1100	F
Set Pressure:	175	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0.0	psig
Operating Pressure:	150	psig
Operating Temperature:	60	F
Thermodynamics Enabled:	☑	
Initial Relief T per Ideal Gas:	☐	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.800	
Nozzle Sizing:	API 520 Vapor	
Outlet Pipe Sizing:	Isothermal	

Scenario Output Data:

Exposed Area:	15	ft2
Required Mass Rate:	323.7	lb/hr
Required Rate Std. Vol.:	0.18	MMSCFD
Required Air Rate:	6500.4	scfh air
Required Mass Flux:	384.0	lb/sec/ft2

Notes:

External Fire Vapor Expansion - API STD 521

Equipment Data:

Equipment Tag:	**F-3052 (C-1052)**	Type:	Pressure Vessel
Drawing:	D-2415-F-04F	MAWP:	270 psig
Description:	C-1052 Fuel Gas Filter	MAWT:	150 F

Relief Stream Composition:

Stream Description: Valley Wells Whistler Fuel Gas

Component	Mole Fraction
carbon dioxide	0.0010
nitrogen	0.0231
methane	0.9535
ethane	0.0220
propane	0.0004
isobutane	0.0000
butane	0.0000
isopentane	
pentane	
hexane	
heptane	
octane	
nonane	
decane	
methanol	
water	

APPENDIX E – Fire Zone #2 – Sulfatreat Area Details

Hydraulic Detailed Results

Knockout Drum Detailed Results

Flare Detailed Sizing Results

Relief Load Calculations

RKR ENGINEERING

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #2 - Sulfatreat Area

Client:	Targa Resources LLC		Increments/Seg.	5	
Project:	Valley Wells Compressor Station		P Atm	14.7	psia
Project Number:	23-1005		Exit Pressure	2	psig
Date:	Mar-24		Roughness	0.00015	feet
Created by:	Rob Kreder		Friction dP Only	FALSE	

Input Data						Calculated Values						Inlet Conditions				Exit Conditions				Results				
Description	Segment	Start Node	End Node	Pipe NPS	Pipe Sch	Pipe ID (inches)	Equivalent Length (ft)	Segment Flow (lb/hr)	Segment Flow (MMSCFD)	Moody f	Fluid MW	P_1 (psig)	T_1 (F)	K_1	ρ_1 (lb/ft^3)	P_2 (psig)	T_2 (F)	K_2	Z_2	Segment ΔP (psi)	Max. Velocity (ft/sec)	Sonic Velocity (ft/sec)	Segment Max. Mach Number	Choke P at Segment Exit (psig)
Reducer To Flare Base	S-1005	N-1010	N-1000	12"	STD	12.000	2.0	75,560	31.63	0.013	21.76	2.1	151.7	1.214	0.056	2.0	151.7	1.214	0.056	0.0	477.2	1302.7	0.37	-8.5
KO Drum to Reducer	S-1015	N-1020	N-1010	20"	20	19.250	86.4	75,560	31.63	0.013	21.76	2.2	151.7	1.214	0.056	2.1	151.7	1.214	0.056	0.1	185.4	1302.7	0.14	-12.3
KO Drum	S-1025	N-1030	N-1020	20"	20	19.250	66.8	75,560	31.63	0.013	21.76	2.3	151.7	1.214	0.057	2.2	151.7	1.214	0.056	0.1	185.4	1302.7	0.14	-12.3
V-1917 Tie In to KO Drum	S-1035	N-1040	N-1030	20"	20	19.250	575.4	75,560	31.63	0.013	21.76	3.3	151.8	1.214	0.060	2.3	151.7	1.214	0.057	0.9	182.2	1302.7	0.14	-12.3
V-1912 to V-1917 Tie In	S-1045	N-1050	N-1040	20"	20	19.250	25.0	75,560	31.63	0.013	21.76	3.3	151.8	1.214	0.060	3.3	151.8	1.214	0.060	0.0	173.1	1302.8	0.13	-12.3
Sulfatreat to V-1912 Tie In	S-1055	N-1060	N-1050	20"	20	19.250	65.0	75,560	31.63	0.013	21.76	3.5	151.8	1.214	0.061	3.3	151.8	1.214	0.060	0.1	173.1	1302.8	0.13	-12.3
Sulfatreat Subheader #1	S-3995	N-4000	N-1060	4"	40	4.026	37.7	75,560	31.63	0.016	21.76	110.7	158.7	1.213	0.420	40.1	154.2	1.214	0.183	70.6	1302.8	1302.8	1.00	40.1
PSV-1811 to Subheader	**S-4005**	**N-4010**	**N-4000**	**2"**	**80**	**1.939**	**26.2**	**18,890**	**7.91**	**0.019**	**21.76**	**164.1**	**162.1**	**1.212**	**0.601**	**110.7**	**158.7**	**1.213**	**0.420**	**53.4**	**609.3**	**1309.6**	**0.47**	**43.6**
Sulfatreat Subheader #2	S-4015	N-4020	N-4000	4"	40	4.026	16.7	56,670	23.72	0.016	21.76	118.1	159.2	1.213	0.445	110.7	158.7	1.213	0.420	7.4	424.0	1309.6	0.32	25.9
PSV-1812 to Subheader	**S-4025**	**N-4030**	**N-4020**	**2"**	**80**	**1.939**	**26.2**	**18,890**	**7.91**	**0.019**	**21.76**	**168.6**	**162.3**	**1.212**	**0.617**	**118.1**	**159.2**	**1.213**	**0.445**	**50.5**	**575.0**	**1310.2**	**0.44**	**43.6**
Sulfatreat Subheader #3	S-4035	N-4040	N-4020	4"	40	4.026	16.7	37,780	15.81	0.016	21.76	121.0	159.4	1.213	0.455	118.1	159.2	1.213	0.445	2.9	266.8	1310.2	0.20	12.3
PSV-1813 to Subheader	**S-4045**	**N-4050**	**N-4040**	**2"**	**80**	**1.939**	**26.2**	**18,890**	**7.91**	**0.019**	**21.76**	**170.4**	**162.5**	**1.212**	**0.623**	**121.0**	**159.4**	**1.213**	**0.455**	**49.4**	**562.4**	**1310.4**	**0.43**	**43.5**
Sulfatreat Subheader #4	S-4055	N-4060	N-4040	4"	40	4.026	16.7	18,890	7.91	0.017	21.76	121.7	159.4	1.213	0.458	121.0	159.4	1.213	0.455	0.7	130.5	1310.4	0.10	-1.2
PSV-1814 to Subheader	**S-4065**	**N-4070**	**N-4060**	**2"**	**80**	**1.939**	**26.2**	**18,890**	**7.91**	**0.019**	**21.76**	**170.9**	**162.5**	**1.212**	**0.625**	**121.7**	**159.4**	**1.213**	**0.458**	**49.2**	**558.7**	**1310.4**	**0.43**	**43.5**

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #2 - Sulfatreat Area

Client:	Targa Resources LLC
Project:	Valley Wells Compressor Station
Project Number:	23-1005
Date:	Mar-24
Created by:	Rob Kreder

Segment Data

Description	Segment	Start Node	End Node	Pipe NPS	Pipe Sch	Pipe ID (inches)	Moody F	Pipe Length (ft)	# 90 Elbows	Eq. Length 90 Elbows	# 45 Elbows	Eq. Length 45 Elbows	Entrances	Eq. Length Entrances	Tee Through	Eq. Length Tee Through	Tee Branch	Eq. Length Tee Branch	Ball Valve	Eq. Length Ball Valve	Equivalent Length (ft)
Reducer To Flare Base	S-1005	N-1010	N-1000	12"	STD	12.000	0.013	2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2.0
KO Drum to Reducer	S-1015	N-1020	N-1010	20"	20	19.250	0.012	19	3	67.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	86.4
KO Drum	S-1025	N-1030	N-1020	20"	20	19.250	0.012	0	0	0.0	0	0.0	1	66.8	0	0.0	0	0.0	0	0.0	66.8
V-1917 Tie In to KO Drum	S-1035	N-1040	N-1030	20"	20	19.250	0.012	508	3	67.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	575.4
V-1912 to V-1917 Tie In	S-1045	N-1050	N-1040	20"	20	19.250	0.012	25	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	25.0
Sulfatreat to V-1912 Tie In	S-1055	N-1060	N-1050	20"	20	19.250	0.012	65	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	65.0
Sulfatreat Subheader #1	S-3995	N-4000	N-1060	4"	40	4.026	0.017	33	1	4.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	37.7
PSV-1811 to Subheader	**S-4005**	**N-4010**	**N-4000**	**2"**	**80**	**1.939**	**0.019**	**6.5**	**3**	**6.8**	**0**	**0.0**	**0**	**0.0**	**1**	**3.2**	**1**	**9.7**	**0**	**0.0**	**26.2**
Sulfatreat Subheader #2	S-4015	N-4020	N-4000	4"	40	4.026	0.017	10	0	0.0	0	0.0	0	0.0	1	6.7	0	0.0	0	0.0	16.7
PSV-1812 to Subheader	**S-4025**	**N-4030**	**N-4020**	**2"**	**80**	**1.939**	**0.019**	**6.5**	**3**	**6.8**	**0**	**0.0**	**0**	**0.0**	**1**	**3.2**	**1**	**9.7**	**0**	**0.0**	**26.2**
Sulfatreat Subheader #3	S-4035	N-4040	N-4020	4"	40	4.026	0.017	10	0	0.0	0	0.0	0	0.0	1	6.7	0	0.0	0	0.0	16.7
PSV-1813 to Subheader	**S-4045**	**N-4050**	**N-4040**	**2"**	**80**	**1.939**	**0.019**	**6.5**	**3**	**6.8**	**0**	**0.0**	**0**	**0.0**	**1**	**3.2**	**1**	**9.7**	**0**	**0.0**	**26.2**
Sulfatreat Subheader #4	S-4055	N-4060	N-4040	4"	40	4.026	0.017	10	0	0.0	0	0.0	0	0.0	1	6.7	0	0.0	0	0.0	16.7
PSV-1814 to Subheader	**S-4065**	**N-4070**	**N-4060**	**2"**	**80**	**1.939**	**0.019**	**6.5**	**3**	**6.8**	**0**	**0.0**	**0**	**0.0**	**1**	**3.2**	**1**	**9.7**	**0**	**0.0**	**26.2**

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #2 - Sulfatreat Area
Flare Knockout Drum Evaluation

Inputs		
Density (Liquid)	40.00	lb/ft^3
Total Liquid In Flow	0	BPD
Low Liquid Level	7%	
Normal Liquid Level	14%	
High Liquid Level	30%	
Minimum Droplet Size	317	microns
Vessel Inner Diameter	6	ft
Selected Vessel Length	20	ft
Results from Hydraulic Evaluation		
Vapor Flowrate	31.63	MMSCFD
Operating Temperature	151.70	F
Operating Pressure	2.35	psig
Atmospheric Pressure	14.7	psia
MW (Vapor)	21.76	
Viscosity (Vapor)	0.01	cp
Density (Vapor)	0.057	lb/ft^3
Mass Flowrate	21.0	lb/s
Volumetric Flowrate	368.7	ft^3/sec
Calculate Terminal Settling Velocity		
Minimum Droplet Size	0.001039	ft
c'(Re)^2	2428.7	
Drag Coefficient C'	1.67	
Terminal Settling Velocity	4.33	ft/s
Calculate Vessel Nozzle Separation Based on Low Level		
Full Area	28.3	ft^2
Required Fall Distance	5.6	ft
Required Residence Time	1.3	sec
Gas Velocity	13.04	ft/sec
Min. Nozzle Separation	16.8	ft
Calculate Vessel Nozzle Separation Based on Normal Level		
Level	0.8	ft
Required Fall Distance	5.2	ft
Required Residence Time	1.2	sec
α	43.9	degrees
x	2.1	ft
Circular Area	21.4	ft^2
Triangle Area	4.5	ft^2
Cross-Sectional Area	25.9	ft^2
Gas Velocity	14.25	ft/sec
Min. Nozzle Separation	17.0	ft
Calculate Vessel Nozzle Separation Based on High Level		
Level	1.8	ft
Required Fall Distance	4.2	ft
Required Residence Time	1.0	sec
α	66.4	degrees
x	2.7	ft
Circular Area	17.8	ft^2
Triangle Area	3.3	ft^2
Cross-Sectional Area	21.1	ft^2
Gas Velocity	17.44	ft/sec
Min. Nozzle Separation	16.9	ft

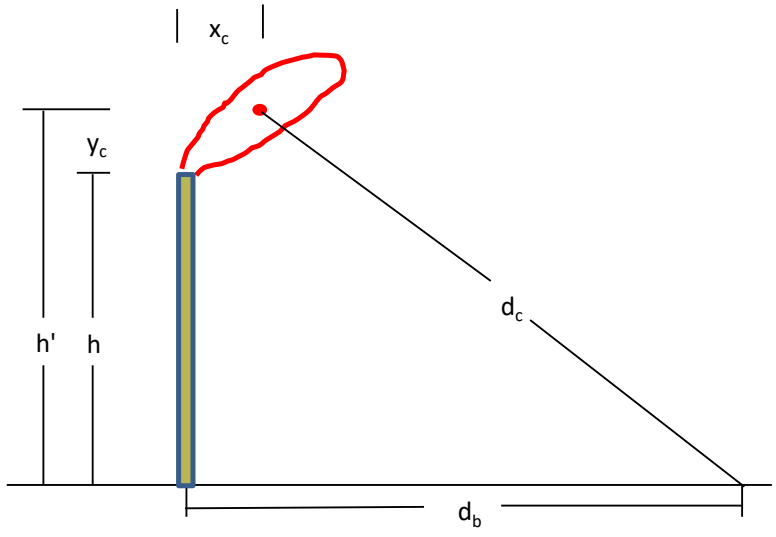
Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #2 - Sulfatreat Area
Flare Tip Radiation and Exit Velocity

Inputs

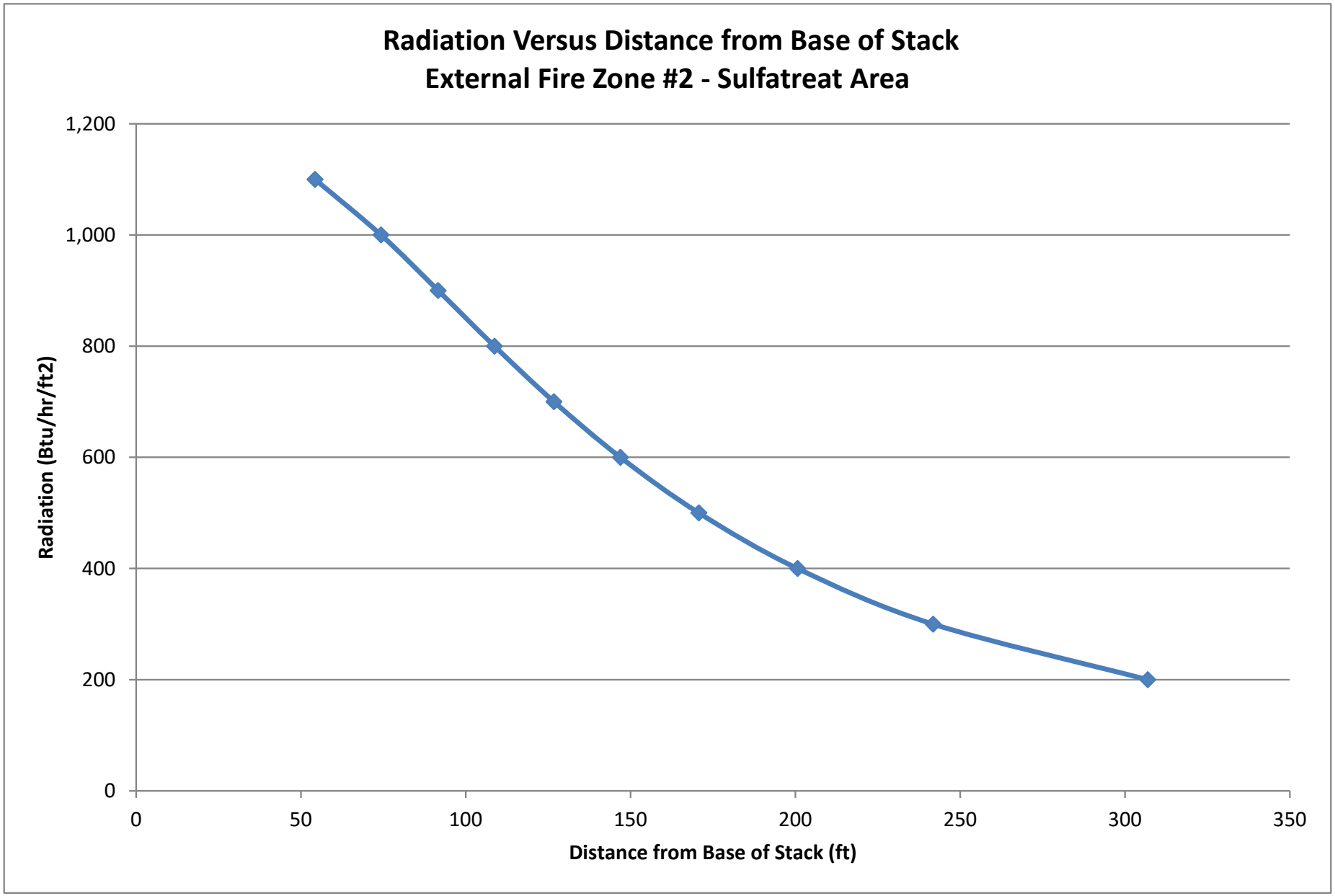
Atmsopheric Pressure	P_{atm}	14.7	psia
Mass Flowrate	q_m	75,560	lb/hr
Temperature	T_j	152	F
Molecular Weight	M_j	21.76	lb/lbmole
Compressibility	Z_j	0.99	
Heat of Combustion	LHV	20,746	Btu/lb
Flare Inner Diameter	d_j	1.17	ft
Flare Height	h	100	ft
Fraction Heat Radiated	F	0.16	
Wind Speed	u_j	20	mph
Ambient Temperature	T_∞	60	F
Horizontal Distance to Flame Center	x_c	19	ft
Vertical Distance to Flame Center	y_c	30	ft

Outputs

Exit Mach Number	Ma_2	0.34	
Isothermal Sonic Velocity	u_s	1182.3	ft/sec
Exit Velocity	u_j	400.9	ft/sec
Mixture LEL	C_L	4.83	vol %
Wind Speed	u_j	29.3	ft/sec
LEL Concentration Parameter	C_L-	0.495	
Jet and Wind Thrust	d_jR	68.6	
Heat Released	Q	1,568	MMBtu/hr
Flame Center Height	h'	130	ft



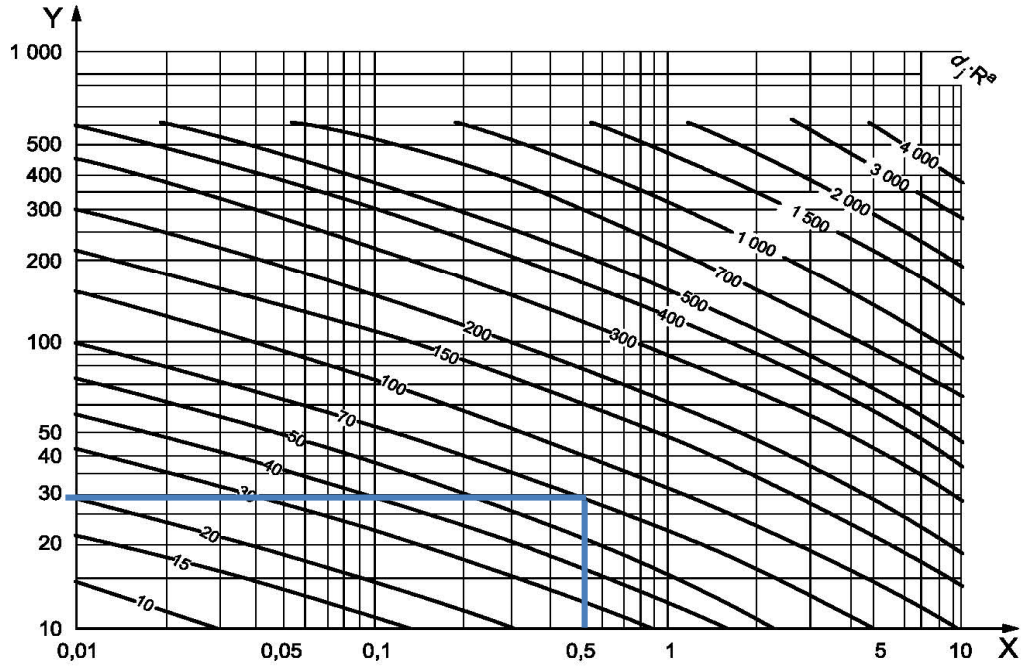
Radiation Level	Distance from Base d_b (ft)	Distance from Center d_c (ft)
200	307	316
300	242	258
400	201	223
500	171	200
600	147	182
700	127	169
800	109	158
900	92	149
1,000	74	141
1,100	54	135
1,200	N/A	129
1,300	N/A	124
1,400	N/A	119
1,500	N/A	115
1,600	N/A	112
1,700	N/A	108
1,800	N/A	105
1,900	N/A	102
2,000	N/A	100
2,100	N/A	97
2,200	N/A	95
2,300	N/A	93
2,400	N/A	91
2,500	N/A	89
2,600	N/A	88
2,700	N/A	86
2,800	N/A	84
2,900	N/A	83
3,000	N/A	82


Radiation Versus Distance from Base of Stack
External Fire Zone #2 - Sulfatreat Area
1,200
1,000
800
600
400
200
0
Radiation (Btu/hr/ft2)
0
50
100
150
200
250
300
350
Distance from Base of Stack (ft)

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #2 - Sulfatreat Area
Flare Gas LEL Calculation

Component	LEL (Vol %)	Gross Heating Value (Btu/scf)	Net Heating Value (Btu/scf)	MW	Mole Fraction	LEL Contribution (%)	HHV Contribution (Btu/scf)	LHV Contribution (Btu/scf)
Hydrogen Sulfide	4.3	1,573.4	1,450.6	34.08	0.0000	0.00000	0.0	0.0
Nitrogen	100.0	-	-	28.01	0.0016	0.16000	0.0	0.0
Methane	5.0	1,010.0	909.4	16.04	0.7639	3.81950	771.5	694.7
Carbon Dioxide	100.0	-	-	44.01	0.0008	0.08000	0.0	0.0
Ethane	3.0	1,769.7	1,618.7	30.07	0.1310	0.39300	231.8	212.0
Propane	2.1	2,516.2	2,314.9	44.10	0.0570	0.11970	143.4	131.9
Butane	1.6	3,262.4	3,010.8	58.12	0.0187	0.02992	61.0	56.3
Isobutane	1.6	3,252.0	3,000.4	58.12	0.0082	0.01312	26.7	24.6
Pentane	1.4	4,008.7	3,706.9	72.15	0.0051	0.00714	20.4	18.9
Isopentane	1.3	4,000.9	3,699.0	72.15	0.0046	0.00598	18.4	17.0
Hexane	1.1	4,756.0	4,403.8	86.18	0.0030	0.00330	14.3	13.2
Cyclohexane	1.3	4,443.5	4,144.6	84.16	0.0011	0.00143	4.9	4.6
Heptane	1.1	5,502.5	5,100.0	100.20	0.0004	0.00044	2.2	2.0
Octane	1.0	6,248.9	5,796.0	114.23	0.0019	0.00190	11.9	11.0
Benzene	1.2	3,741.9	3,590.9	78.11	0.0008	0.00096	3.0	2.9
Water	100.0	-	-	18.02	0.0019	0.19000	0.0	0.0
					1.0000	4.82639	1,310	1,189

Mixture MW	**21.75**	**lb/lbmole**
Mixture LEL	**4.83**	**Vol %**
Mixture HHV	**1,310**	**Btu/scf**
Mixture HHV	**22,845**	**Btu/lbm**
Mixture LHV	**1,189**	**Btu/scf**
Mixture LHV	**20,746**	**Btu/lbm**



Key

X $\overline{C_L}$, the lower-explosive-limit concentration parameter for the flare gas, see Equation (C.7)

Y y_c, vertical distance from the stack to flame centre, expressed in feet

[a] $(d_j \cdot R)$ is the parameter for jet thrust and wind thrust, see Equation (C.8).

Figure C.5 — Flame centre for flares and ignited vents — Vertical distance, y_c (USC units)

C.3.4 Calculation of the distance from the flame centre to the object or point being considered

The design basis for this calculation is as follows: The fraction of heat radiated, F, is 0,3. The heat liberated (see C.2.3), Q, is $6{,}3 \times 10^6$ kW ($2{,}15 \times 10^{10}$ Btu/h). Say the flare stack design must limit the maximum allowable radiation (see 6.4.2.3), K, is 9,5 kW/m^2 (3 000 Btu/h·ft^2).

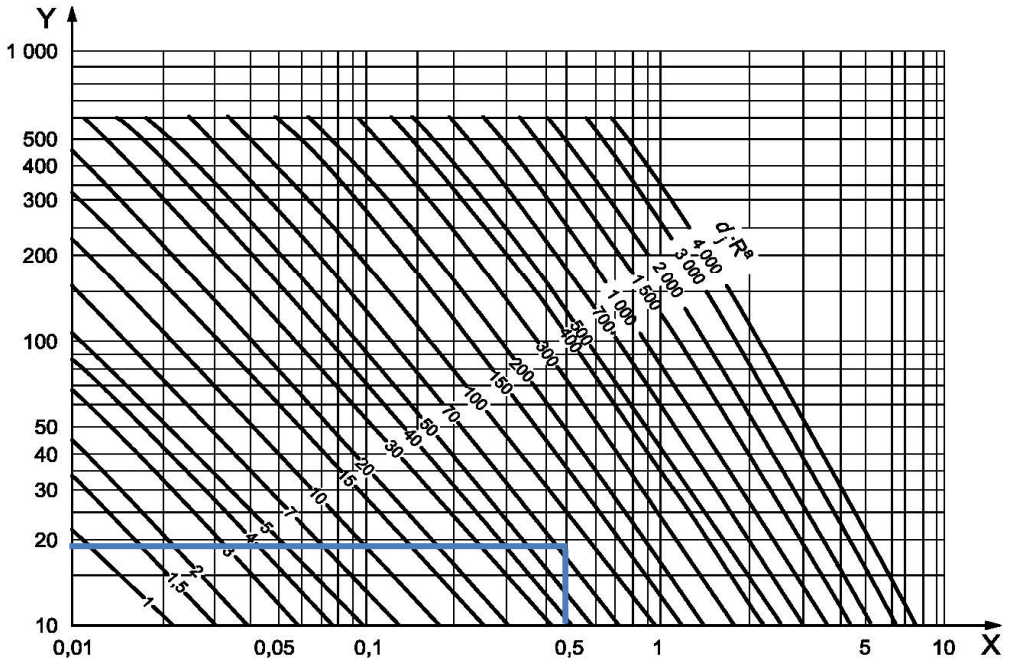
In Equation (24), the value of τ should be assumed to be 1,0 (see C.3.6.3 and C.3.6.4). The distance from the flame centre to the object or point being considered (that is, the distance to the limit of the radiant heat intensity, such as grade level, an equipment platform, or a plant boundary), D, is then calculated as follows:

$$D = \sqrt{\frac{\tau \cdot F \cdot Q}{4\pi \cdot K}} \tag{24}$$

In SI units:

$$D = \sqrt{\frac{1{,}0 \times 0{,}3 \times 6{,}3 \times 10^6}{4\pi \times 9{,}5}} = 126 \text{ m}$$

API Standard 521 / ISO 23251



Key

X $\overline{C_L}$, the lower-explosive-limit concentration parameter for the flare gas, see Equation (C.7)

Y x_c, horizontal distance from the stack to flame centre, expressed in feet

[a] $(d_j \cdot R)$ is the parameter for jet thrust and wind thrust, see Equation (C.8).

Figure C.3 — Flame centre for flares and ignited vents — Horizontal distance, x_c (USC units)

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1811**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	Sulfatreat Vessel	MAWT:	130 F

Scenario Description:

The Sulfatreat Vessel should always be free of liquid and the vapor would be supercritical at the relief pressure of 1742.4 psig. As such, an external fire could result in overpressure due to expansion of the fluid. The required relief rate was based on the normal sweet gas composition.. Initial operating conditions were 1,300 psig and 120 F. The heat input was based on the entire surface area of the vessel.

Scenario Calculation Results:

Required Rate:	18,890.1	lb/hr	Device Choke Pressure:	958.3	psig
Actual Capacity:	35,473.6	lb/hr	Outlet Temperature:	151.6	F
Required Area:	0.19	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.3568	in2	Outlet Density:	0.048	lb/ft3
Relief Pressure:	1742.4	psig	Outlet Ideal Cp/Cv:	1.215	
Relief Temperature:	234.5	F	Outlet Viscosity:	0.012	cP
Relief MW:	21.75		Inlet Non-Recoverble dP:	8.5	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.6	% Set
Relief Density:	5.964	lb/ft3	Built-Up Back Pressure:	243.5	psig
Relief SG:	0.750		Built-Up Back P % Set:	16.9	% Set
Relief Z:	0.860		Total Back Pressure:	243.5	psig
Relief Ideal Cp/Cv:	1.198		Total Back P % Set:	16.9	% Set
Relief Viscosity:	0.013				

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1811**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	Sulfatreat Vessel	MAWT:	130 F

Scenario Input Data:

Heat Input Calculation:

Length:	20	ft	Bottom Elevation:	3.5	ft
Diameter:	6	ft	Adequate Drainage	☐	
Orientation:	Vertical		Insulation Factor:	1	
Head Type:	2:1 Ellipsoidal		Include Entire Area:	☑	
Additional Wetted Area:	0	ft2	**Scenario Output Data:**		
Level:	0%		Wetted Area:	455	ft2
Level Basis:	Dry		Heat Input:	5.217	MMBtu/hr

Initial Mass and Expansion Rate Calculation:

Operating Pressure:	1300	psig	Vapor Mass:	3632.3	lb
Operating Pressure Basis:	Maximum Operating		Initial Density:	6.12	lb/ft3
Bubblepoint Liquid:	☐		Initial Specific Volume:	0.1634	ft3/lb
Operating Temperature:	120	F	Initial Relief Temperature:	224.5	F
Set Pressure:	1440	psig	Start Temp. for Expansion:	224.5	F
Allowable Overpressure:	21.0%		Average Mass:	3756.6	lb
Constant Back Pressure:	0	psig	Start Density for Expansion:	6.115	lb/ft3
Temperature Increment:	10	F	Start Cp for Expansion:	0.692	Btu/lb/F
Use Thermodynamics:	☑		Relief Cp:	0.689	Btu/lb/F
Relief Device KdV:	0.855		Average Cp:	0.69	Btu/lb/F
Relief Device KdL:	0.670		Start Enthalpy for Expansion:	5349.9	Btu/lb
Nozzle Sizing:	API Numerical Integration Vapor		Stop Enthalpy for Expansion:	5500.2	Btu/lb/F
Outlet Pipe Sizing:	Isothermal		Maximum Volumetric Flow:	143.7	ft3/hr
Operating Vapor Density:	6.118	lb/ft3	Heat Increment:	25939.1	Btu
Operating Liquid Density:	6.118	lb/ft3	Time Increment:	0.30	min
Total Volume:	622	ft3	Relief Mass Flux:	3976.9	lb/sec/ft2
Initial Mass:	3805.6	lb	Kd:	0.855	
Liquid Mass:	173.3	lb			

Notes:

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1811**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	Sulfatreat Vessel	MAWT:	130 F

Relief Stream Composition:

	V-1811 Fire Vapor Relief	Valley Wells Sweet HP Gas	Valley Wells Sweet HP Gas
Component	**Mole Fraction**	**Mole Fraction**	**Mole Fraction**
hydrogen sulfide	0.0000	0.0000	0.0000
nitrogen	0.0016	0.0016	0.0016
methane	0.7639	0.7639	0.7639
carbon dioxide	0.0008	0.0008	0.0008
ethane	0.1310	0.1310	0.1310
propane	0.0570	0.0570	0.0570
butane	0.0187	0.0187	0.0187
isobutane	0.0082	0.0082	0.0082
ipentane	0.0051	0.0051	0.0051
isopentane	0.0046	0.0046	0.0046
hexane	0.0030	0.0030	0.0030
cyclohexane	0.0011	0.0011	0.0011
heptane	0.0004	0.0004	0.0004
octane	0.0019	0.0019	0.0019
benzene	0.0008	0.0008	0.0008
ethylbenzene	0.0000	0.0000	0.0000
water	0.0019	0.0019	0.0019

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1812**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	SulfaTreat Vessel	MAWT:	130 F

Scenario Description:

The Sulfatreat Vessel should always be free of liquid and the vapor would be supercritical at the relief pressure of 1742.4 psig. As such, an external fire could result in overpressure due to expansion of the fluid. The required relief rate was based on the normal sweet gas composition.. Initial operating conditions were 1,300 psig and 120 F. The heat input was based on the entire surface area of the vessel.

Scenario Calculation Results:

Required Rate:	18,890.1	lb/hr	Device Choke Pressure:	958.3	psig
Actual Capacity:	35,473.6	lb/hr	Outlet Temperature:	151.6	F
Required Area:	0.19	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.3568	in2	Outlet Density:	0.048	lb/ft3
Relief Pressure:	1742.4	psig	Outlet Ideal Cp/Cv:	1.215	
Relief Temperature:	234.5	F	Outlet Viscosity:	0.012	cP
Relief MW:	21.75		Inlet Non-Recoverble dP:	8.5	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.6	% Set
Relief Density:	5.964	lb/ft3	Built-Up Back Pressure:	243.5	psig
Relief SG:	0.750		Built-Up Back P % Set:	16.9	% Set
Relief Z:	0.860		Total Back Pressure:	243.5	psig
Relief Ideal Cp/Cv:	1.198		Total Back P % Set:	16.9	% Set
Relief Viscosity:	0.013				

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1812**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	SulfaTreat Vessel	MAWT:	130 F

Scenario Input Data:

Heat Input Calculation:

Length:	20	ft	Bottom Elevation:	3.5	ft
Diameter:	6	ft	Adequate Drainage	☐	
Orientation:	Vertical		Insulation Factor:	1	
Head Type:	2:1 Ellipsoidal		Include Entire Area:	☑	
Additional Wetted Area:	0	ft2	**Scenario Output Data:**		
Level:	0%		Wetted Area:	455	ft2
Level Basis:	Dry		Heat Input:	5.217	MMBtu/hr

Initial Mass and Expansion Rate Calculation:

Operating Pressure:	1300	psig	Vapor Mass:	3632.3	lb
Operating Pressure Basis:	Maximum Operating		Initial Density:	6.12	lb/ft3
Bubblepoint Liquid:	☐		Initial Specific Volume:	0.1634	ft3/lb
Operating Temperature:	120	F	Initial Relief Temperature:	224.5	F
Set Pressure:	1440	psig	Start Temp. for Expansion:	224.5	F
Allowable Overpressure:	21.0%		Average Mass:	3756.6	lb
Constant Back Pressure:	0	psig	Start Density for Expansion:	6.115	lb/ft3
Temperature Increment:	10	F	Start Cp for Expansion:	0.692	Btu/lb/F
Use Thermodynamics:	☑		Relief Cp:	0.689	Btu/lb/F
Relief Device KdV:	0.855		Average Cp:	0.69	Btu/lb/F
Relief Device KdL:	0.670		Start Enthalpy for Expansion:	5349.9	Btu/lb
Nozzle Sizing:	API Numerical Integration Vapor		Stop Enthalpy for Expansion:	5500.2	Btu/lb/F
Outlet Pipe Sizing:	Isothermal		Maximum Volumetric Flow:	143.7	ft3/hr
Operating Vapor Density:	6.118	lb/ft3	Heat Increment:	25939.1	Btu
Operating Liquid Density:	6.118	lb/ft3	Time Increment:	0.30	min
Total Volume:	622	ft3	Relief Mass Flux:	3976.9	lb/sec/ft2
Initial Mass:	3805.6	lb	Kd:	0.855	
Liquid Mass:	173.3	lb			

Notes:

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1812**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	SulfaTreat Vessel	MAWT:	130 F

Relief Stream Composition:

	V-1811_2_3_4 Fire Vapor Relief	Valley Wells Sweet HP Gas	Valley Wells Sweet HP Gas
Component	**Mole Fraction**	**Mole Fraction**	**Mole Fraction**
hydrogen sulfide	0.0000	0.0000	0.0000
nitrogen	0.0016	0.0016	0.0016
methane	0.7639	0.7639	0.7639
carbon dioxide	0.0008	0.0008	0.0008
ethane	0.1310	0.1310	0.1310
propane	0.0570	0.0570	0.0570
butane	0.0187	0.0187	0.0187
isobutane	0.0082	0.0082	0.0082
ipentane	0.0051	0.0051	0.0051
isopentane	0.0046	0.0046	0.0046
hexane	0.0030	0.0030	0.0030
cyclohexane	0.0011	0.0011	0.0011
heptane	0.0004	0.0004	0.0004
octane	0.0019	0.0019	0.0019
benzene	0.0008	0.0008	0.0008
ethylbenzene	0.0000	0.0000	0.0000
water	0.0019	0.0019	0.0019

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1813**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	SulfaTreat Vessel	MAWT:	130 F

Scenario Description:

The Sulfatreat Vessel should always be free of liquid and the vapor would be supercritical at the relief pressure of 1742.4 psig. As such, an external fire could result in overpressure due to expansion of the fluid. The required relief rate was based on the normal sweet gas composition.. Initial operating conditions were 1,300 psig and 120 F. The heat input was based on the entire surface area of the vessel.

Scenario Calculation Results:

Required Rate:	18,890.1	lb/hr	Device Choke Pressure:	958.3	psig
Actual Capacity:	35,473.6	lb/hr	Outlet Temperature:	151.6	F
Required Area:	0.19	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.3568	in2	Outlet Density:	0.048	lb/ft3
Relief Pressure:	1742.4	psig	Outlet Ideal Cp/Cv:	1.215	
Relief Temperature:	234.5	F	Outlet Viscosity:	0.012	cP
Relief MW:	21.75		Inlet Non-Recoverble dP:	8.5	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.6	% Set
Relief Density:	5.964	lb/ft3	Built-Up Back Pressure:	243.5	psig
Relief SG:	0.750		Built-Up Back P % Set:	16.9	% Set
Relief Z:	0.860		Total Back Pressure:	243.5	psig
Relief Ideal Cp/Cv:	1.198		Total Back P % Set:	16.9	% Set
Relief Viscosity:	0.013				

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1813**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	SulfaTreat Vessel	MAWT:	130 F

Scenario Input Data:

Heat Input Calculation:

Length:	20	ft	Bottom Elevation:	3.5	ft
Diameter:	6	ft	Adequate Drainage	☐	
Orientation:	Vertical		Insulation Factor:	1	
Head Type:	2:1 Ellipsoidal		Include Entire Area:	☑	
Additional Wetted Area:	0	ft2	**Scenario Output Data:**		
Level:	0%		Wetted Area:	455	ft2
Level Basis:	Dry		Heat Input:	5.217	MMBtu/hr

Initial Mass and Expansion Rate Calculation:

Operating Pressure:	1300	psig	Vapor Mass:	3632.3	lb
Operating Pressure Basis:	Maximum Operating		Initial Density:	6.12	lb/ft3
Bubblepoint Liquid:	☐		Initial Specific Volume:	0.1634	ft3/lb
Operating Temperature:	120	F	Initial Relief Temperature:	224.5	F
Set Pressure:	1440	psig	Start Temp. for Expansion:	224.5	F
Allowable Overpressure:	21.0%		Average Mass:	3756.6	lb
Constant Back Pressure:	0	psig	Start Density for Expansion:	6.115	lb/ft3
Temperature Increment:	10	F	Start Cp for Expansion:	0.692	Btu/lb/F
Use Thermodynamics:	☑		Relief Cp:	0.689	Btu/lb/F
Relief Device KdV:	0.855		Average Cp:	0.69	Btu/lb/F
Relief Device KdL:	0.670		Start Enthalpy for Expansion:	5349.9	Btu/lb
Nozzle Sizing:	API Numerical Integration Vapor		Stop Enthalpy for Expansion:	5500.2	Btu/lb/F
Outlet Pipe Sizing:	Isothermal		Maximum Volumetric Flow:	143.7	ft3/hr
Operating Vapor Density:	6.118	lb/ft3	Heat Increment:	25939.1	Btu
Operating Liquid Density:	6.118	lb/ft3	Time Increment:	0.30	min
Total Volume:	622	ft3	Relief Mass Flux:	3976.9	lb/sec/ft2
Initial Mass:	3805.6	lb	Kd:	0.855	
Liquid Mass:	173.3	lb			

Notes:

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1813**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	SulfaTreat Vessel	MAWT:	130 F

Relief Stream Composition:

	V-1811_2_3_4 Fire Vapor Relief	Valley Wells Sweet HP Gas	Valley Wells Sweet HP Gas
Component	**Mole Fraction**	**Mole Fraction**	**Mole Fraction**
hydrogen sulfide	0.0000	0.0000	0.0000
nitrogen	0.0016	0.0016	0.0016
methane	0.7639	0.7639	0.7639
carbon dioxide	0.0008	0.0008	0.0008
ethane	0.1310	0.1310	0.1310
propane	0.0570	0.0570	0.0570
butane	0.0187	0.0187	0.0187
isobutane	0.0082	0.0082	0.0082
ipentane	0.0051	0.0051	0.0051
isopentane	0.0046	0.0046	0.0046
hexane	0.0030	0.0030	0.0030
cyclohexane	0.0011	0.0011	0.0011
heptane	0.0004	0.0004	0.0004
octane	0.0019	0.0019	0.0019
benzene	0.0008	0.0008	0.0008
ethylbenzene	0.0000	0.0000	0.0000
water	0.0019	0.0019	0.0019

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1814**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	SulfaTreat Vessel	MAWT:	130 F

Scenario Description:

The Sulfatreat Vessel should always be free of liquid and the vapor would be supercritical at the relief pressure of 1742.4 psig. As such, an external fire could result in overpressure due to expansion of the fluid. The required relief rate was based on the normal sweet gas composition.. Initial operating conditions were 1,300 psig and 120 F. The heat input was based on the entire surface area of the vessel.

Scenario Calculation Results:

Required Rate:	18,890.1	lb/hr	Device Choke Pressure:	958.3	psig
Actual Capacity:	35,473.6	lb/hr	Outlet Temperature:	151.6	F
Required Area:	0.19	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.3568	in2	Outlet Density:	0.048	lb/ft3
Relief Pressure:	1742.4	psig	Outlet Ideal Cp/Cv:	1.215	
Relief Temperature:	234.5	F	Outlet Viscosity:	0.012	cP
Relief MW:	21.75		Inlet Non-Recoverble dP:	8.5	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.6	% Set
Relief Density:	5.964	lb/ft3	Built-Up Back Pressure:	243.5	psig
Relief SG:	0.750		Built-Up Back P % Set:	16.9	% Set
Relief Z:	0.860		Total Back Pressure:	243.5	psig
Relief Ideal Cp/Cv:	1.198		Total Back P % Set:	16.9	% Set
Relief Viscosity:	0.013				

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1814**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	SulfaTreat Vessel	MAWT:	130 F

Scenario Input Data:

Heat Input Calculation:

Length:	20	ft	Bottom Elevation:	3.5	ft
Diameter:	6	ft	Adequate Drainage	☐	
Orientation:	Vertical		Insulation Factor:	1	
Head Type:	2:1 Ellipsoidal		Include Entire Area:	☑	
Additional Wetted Area:	0	ft2	**Scenario Output Data:**		
Level:	0%		Wetted Area:	455	ft2
Level Basis:	Dry		Heat Input:	5.217	MMBtu/hr

Initial Mass and Expansion Rate Calculation:

Operating Pressure:	1300	psig	Vapor Mass:	3632.3	lb
Operating Pressure Basis:	Maximum Operating		Initial Density:	6.12	lb/ft3
Bubblepoint Liquid:	☐		Initial Specific Volume:	0.1634	ft3/lb
Operating Temperature:	120	F	Initial Relief Temperature:	224.5	F
Set Pressure:	1440	psig	Start Temp. for Expansion:	224.5	F
Allowable Overpressure:	21.0%		Average Mass:	3756.6	lb
Constant Back Pressure:	0	psig	Start Density for Expansion:	6.115	lb/ft3
Temperature Increment:	10	F	Start Cp for Expansion:	0.692	Btu/lb/F
Use Thermodynamics:	☑		Relief Cp:	0.689	Btu/lb/F
Relief Device KdV:	0.855		Average Cp:	0.69	Btu/lb/F
Relief Device KdL:	0.670		Start Enthalpy for Expansion:	5349.9	Btu/lb
Nozzle Sizing:	API Numerical Integration Vapor		Stop Enthalpy for Expansion:	5500.2	Btu/lb/F
Outlet Pipe Sizing:	Isothermal		Maximum Volumetric Flow:	143.7	ft3/hr
Operating Vapor Density:	6.118	lb/ft3	Heat Increment:	25939.1	Btu
Operating Liquid Density:	6.118	lb/ft3	Time Increment:	0.30	min
Total Volume:	622	ft3	Relief Mass Flux:	3976.9	lb/sec/ft2
Initial Mass:	3805.6	lb	Kd:	0.855	
Liquid Mass:	173.3	lb			

Notes:

External Fire Supercritical Fluid Expansion

Equipment Data:

Equipment Tag:	**V-1814**	Type:	Pressure Vessel
Drawing:	D-2415-F-14	MAWP:	1440 psig
Description:	SulfaTreat Vessel	MAWT:	130 F

Relief Stream Composition:

	V-1811_2_3_4 Fire Vapor Relief	Valley Wells Sweet HP Gas	Valley Wells Sweet HP Gas
Component	**Mole Fraction**	**Mole Fraction**	**Mole Fraction**
hydrogen sulfide	0.0000	0.0000	0.0000
nitrogen	0.0016	0.0016	0.0016
methane	0.7639	0.7639	0.7639
carbon dioxide	0.0008	0.0008	0.0008
ethane	0.1310	0.1310	0.1310
propane	0.0570	0.0570	0.0570
butane	0.0187	0.0187	0.0187
isobutane	0.0082	0.0082	0.0082
ipentane	0.0051	0.0051	0.0051
isopentane	0.0046	0.0046	0.0046
hexane	0.0030	0.0030	0.0030
cyclohexane	0.0011	0.0011	0.0011
heptane	0.0004	0.0004	0.0004
octane	0.0019	0.0019	0.0019
benzene	0.0008	0.0008	0.0008
ethylbenzene	0.0000	0.0000	0.0000
water	0.0019	0.0019	0.0019

APPENDIX F – Fire Zone #3 – Closed Drain Tank Area Details

Hydraulic Detailed Results

Knockout Drum Detailed Results

Flare Detailed Sizing Results

Relief Load Calculations

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #3 - Closed Drain Tank Area

Client:	Targa Resources LLC		Increments/Seg.	5	
Project:	Valley Wells Compressor Station		P Atm	14.7	psia
Project Number:	23-1005		Exit Pressure	2	psig
Date:	Mar-24		Roughness	0.00015	feet
Created by:	Rob Kreder		Friction dP Only	FALSE	

Input Data						Calculated Values						Inlet Conditions				Exit Conditions				Results				
Description	Segment	Start Node	End Node	Pipe NPS	Pipe Sch	Pipe ID (inches)	Equivalent Length (ft)	Segment Flow (lb/hr)	Segment Flow (MMSCFD)	Moody f	Fluid MW	P_1 (psig)	T_1 (F)	K_1	ρ_1 (lb/ft^3)	P_2 (psig)	T_2 (F)	K_2	Z_2	Segment ΔP (psi)	Max. Velocity (ft/sec)	Sonic Velocity (ft/sec)	Segment Max. Mach Number	Choke P at Segment Exit (psig)
Reducer To Flare Base	S-1005	N-1010	N-1000	12"	STD	12.000	2.0	213,432	26.59	0.013	73.12	2.2	351.8	1.052	0.145	2.0	351.8	1.052	0.142	0.2	531.6	762.1	0.70	-3.1
KO Drum to Reducer	S-1015	N-1020	N-1010	20"	20	19.250	86.4	213,432	26.59	0.012	73.12	2.7	351.9	1.052	0.149	2.2	351.8	1.052	0.145	0.5	202.3	762.1	0.27	-10.2
KO Drum	S-1025	N-1030	N-1020	20"	20	19.250	66.8	213,432	26.59	0.012	73.12	3.1	351.9	1.052	0.152	2.7	351.9	1.052	0.149	0.3	196.9	762.2	0.26	-10.2
V-1917 Tie In to KO Drum	S-1035	N-1040	N-1030	20"	20	19.250	575.4	213,432	26.59	0.012	73.12	5.7	352.2	1.052	0.175	3.1	351.9	1.052	0.152	2.7	193.0	762.2	0.25	-10.2
PSV-1917 to Main Header	**S-2995**	**N-3000**	**N-1040**	**3"**	**40**	**3.068**	**43.7**	**82,727**	**10.17**	**0.017**	**74.07**	**147.0**	**374.9**	**1.050**	**1.573**	**53.8**	**363.9**	**1.051**	**0.613**	**93.2**	**760.0**	**760.0**	**1.00**	**53.8**
V-1912 to V-1917 Tie In	S-1045	N-1050	N-1040	20"	20	19.250	25.0	130,705	16.42	0.012	72.52	5.8	348.0	1.053	0.175	5.7	348.0	1.053	0.174	0.0	103.2	763.8	0.14	-11.9
PSV-1912 to Main Header	**S-3005**	**N-3010**	**N-1050**	**4"**	**40**	**4.026**	**56.4**	**130,705**	**16.42**	**0.016**	**72.52**	**131.6**	**362.7**	**1.052**	**1.389**	**48.4**	**352.8**	**1.053**	**0.556**	**83.3**	**763.8**	**763.8**	**1.00**	**48.4**

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #3 - Closed Drain Tank Area

Client:	Targa Resources LLC
Project:	Valley Wells Compressor Station
Project Number:	23-1005
Date:	Mar-24
Created by:	Rob Kreder

Segment Data

Description	Segment	Start Node	End Node	Pipe NPS	Pipe Sch	Pipe ID (inches)	Moody F	Pipe Length (ft)	# 90 Elbows	Eq. Length 90 Elbows	# 45 Elbows	Eq. Length 45 Elbows	Entrances	Eq. Length Entrances	Tee Through	Eq. Length Tee Through	Tee Branch	Eq. Length Tee Branch	Ball Valve	Eq. Length Ball Valve	Equivalent Length (ft)
Reducer To Flare Base	S-1005	N-1010	N-1000	12"	STD	12.000	0.013	2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2.0
KO Drum to Reducer	S-1015	N-1020	N-1010	20"	20	19.250	0.012	19	3	67.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	86.4
KO Drum	S-1025	N-1030	N-1020	20"	20	19.250	0.012	0	0	0.0	0	0.0	1	66.8	0	0.0	0	0.0	0	0.0	66.8
V-1917 Tie In to KO Drum	S-1035	N-1040	N-1030	20"	20	19.250	0.012	508	3	67.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	575.4
PSV-1917 to Main Header	**S-2995**	**N-3000**	**N-1040**	**3"**	**40**	**3.068**	**0.018**	**35**	**1**	**3.6**	**0**	**0.0**	**0**	**0.0**	**1**	**5.1**	**0**	**0.0**	**0**	**0.0**	**43.7**
V-1912 to V-1917 Tie In	S-1045	N-1050	N-1040	20"	20	19.250	0.012	25	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	25.0
PSV-1912 to Main Header	**S-3005**	**N-3010**	**N-1050**	**4"**	**40**	**4.026**	**0.017**	**45**	**1**	**4.7**	**0**	**0.0**	**0**	**0.0**	**1**	**6.7**	**0**	**0.0**	**0**	**0.0**	**56.4**

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #3 - Closed Drain Tank Area
Flare Knockout Drum Evaluation

Inputs		
Density (Liquid)	40.00	lb/ft^3
Total Liquid In Flow	0	BPD
Low Liquid Level	7%	
Normal Liquid Level	14%	
High Liquid Level	30%	
Minimum Droplet Size	463	microns
Vessel Inner Diameter	6	ft
Selected Vessel Length	20	ft
Results from Hydraulic Evaluation		
Vapor Flowrate	26.59	MMSCFD
Operating Temperature	351.90	F
Operating Pressure	3.06	psig
Atmospheric Pressure	14.7	psia
MW (Vapor)	73.12	
Viscosity (Vapor)	0.01	cp
Density (Vapor)	0.152	lb/ft^3
Mass Flowrate	59.4	lb/s
Volumetric Flowrate	390.6	ft^3/sec
Calculate Terminal Settling Velocity		
Minimum Droplet Size	0.001519	ft
c'(Re)^2	20174.5	
Drag Coefficient C'	0.81	
Terminal Settling Velocity	4.58	ft/s
Calculate Vessel Nozzle Separation Based on Low Level		
Full Area	28.3	ft^2
Required Fall Distance	5.6	ft
Required Residence Time	1.2	sec
Gas Velocity	13.81	ft/sec
Min. Nozzle Separation	16.8	ft
Calculate Vessel Nozzle Separation Based on Normal Level		
Level	0.8	ft
Required Fall Distance	5.2	ft
Required Residence Time	1.1	sec
α	43.9	degrees
x	2.1	ft
Circular Area	21.4	ft^2
Triangle Area	4.5	ft^2
Cross-Sectional Area	25.9	ft^2
Gas Velocity	15.10	ft/sec
Min. Nozzle Separation	17.0	ft
Calculate Vessel Nozzle Separation Based on High Level		
Level	1.8	ft
Required Fall Distance	4.2	ft
Required Residence Time	0.9	sec
α	66.4	degrees
x	2.7	ft
Circular Area	17.8	ft^2
Triangle Area	3.3	ft^2
Cross-Sectional Area	21.1	ft^2
Gas Velocity	18.47	ft/sec
Min. Nozzle Separation	16.9	ft

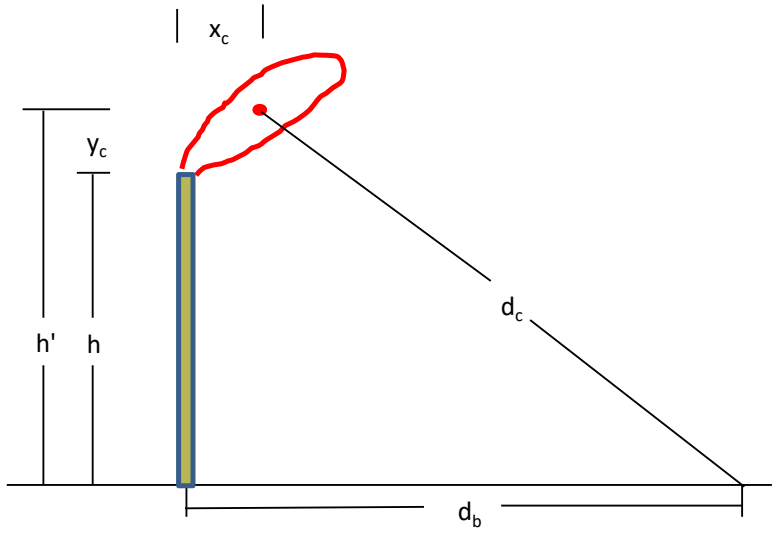
Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #3 - Closed Drain Tank Area
Flare Tip Radiation and Exit Velocity

Inputs

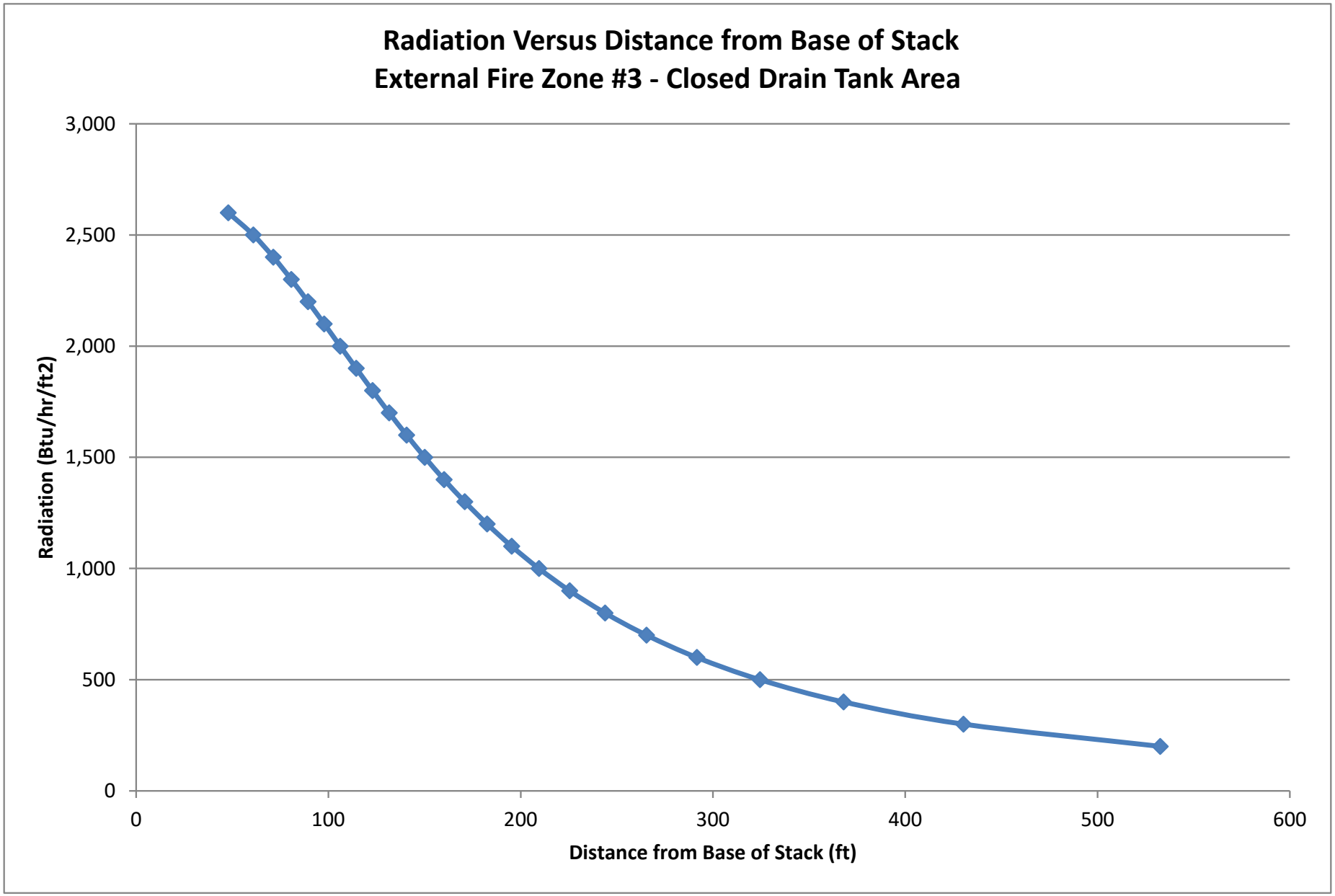
Atmsopheric Pressure	P_{atm}	14.7	psia
Mass Flowrate	q_m	213,432	lb/hr
Temperature	T_j	352	F
Molecular Weight	M_j	73.12	lb/lbmole
Compressibility	Z_j	0.99	
Heat of Combustion	LHV	20,811	Btu/lb
Flare Inner Diameter	d_j	1.17	ft
Flare Height	h	100	ft
Fraction Heat Radiated	F	0.16	
Wind Speed	u_j	20	mph
Ambient Temperature	T_∞	60	F
Horizontal Distance to Flame Center	x_c	21	ft
Vertical Distance to Flame Center	y_c	45	ft

Outputs

Exit Mach Number	Ma_2	0.60	
Isothermal Sonic Velocity	u_s	743.0	ft/sec
Exit Velocity	u_j	447.2	ft/sec
Mixture LEL	C_L	1.56	vol %
Wind Speed	u_j	29.3	ft/sec
LEL Concentration Parameter	C_L-	0.601	
Jet and Wind Thrust	d_jR	121.7	
Heat Released	Q	4,442	MMBtu/hr
Flame Center Height	h'	145	ft



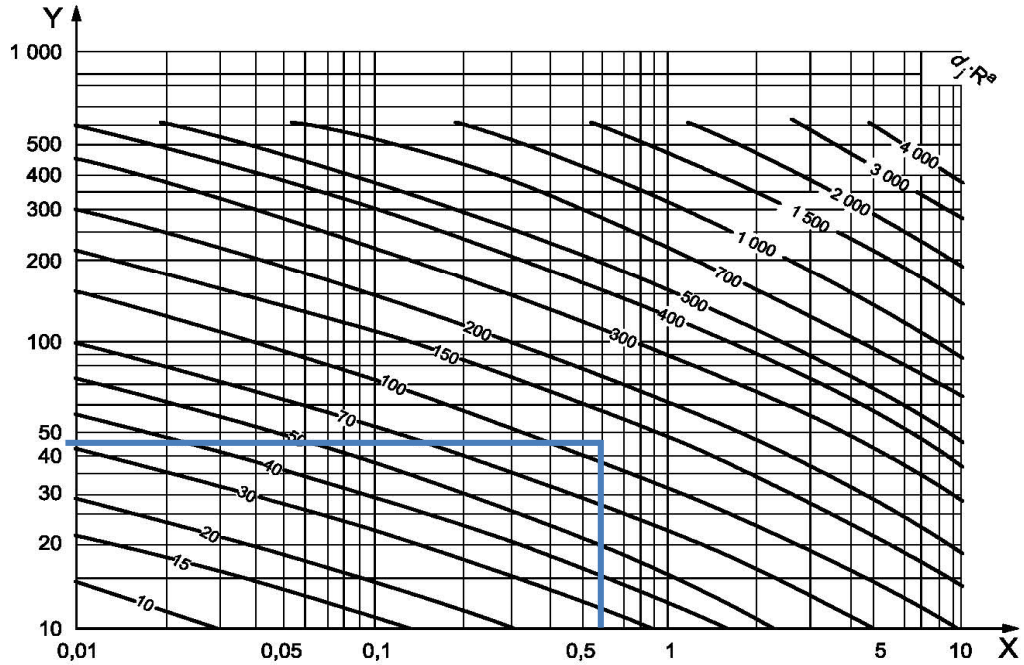
Radiation Level	Distance from Base d_b (ft)	Distance from Center d_c (ft)
200	533	532
300	430	434
400	368	376
500	324	336
600	292	307
700	265	284
800	244	266
900	225	251
1,000	209	238
1,100	195	227
1,200	183	217
1,300	171	209
1,400	160	201
1,500	150	194
1,600	141	188
1,700	132	182
1,800	123	177
1,900	114	173
2,000	106	168
2,100	98	164
2,200	89	160
2,300	81	157
2,400	71	154
2,500	61	150
2,600	48	147
2,700	N/A	145
2,800	N/A	142
2,900	N/A	140
3,000	N/A	137


Radiation Versus Distance from Base of Stack
External Fire Zone #3 - Closed Drain Tank Area
3,000
2,500
2,000
1,500
1,000
500
0
Radiation (Btu/hr/ft2)
0
100
200
300
400
500
600
Distance from Base of Stack (ft)

Targa Resources LLC
Valley Wells Compressor Station
External Fire Zone #3 - Closed Drain Tank Area
Flare Gas LEL Calculation

Component	LEL (Vol %)	Gross Heating Value (Btu/scf)	Net Heating Value (Btu/scf)	MW	Mole Fraction	LEL Contribution (%)	HHV Contribution (Btu/scf)	LHV Contribution (Btu/scf)
Hydrogen Sulfide	4.3	1,573.4	1,450.6	34.08	0.0000	0.00000	0.0	0.0
Nitrogen	100.0	-	-	28.01	0.0000	0.00000	0.0	0.0
Methane	5.0	1,010.0	909.4	16.04	0.0257	0.12865	26.0	23.4
Carbon Dioxide	100.0	-	-	44.01	0.0004	0.04000	0.0	0.0
Ethane	3.0	1,769.7	1,618.7	30.07	0.0554	0.16616	98.0	89.7
Propane	2.1	2,516.2	2,314.9	44.10	0.1210	0.25406	304.4	280.1
Butane	1.6	3,262.4	3,010.8	58.12	0.1649	0.26391	538.1	496.6
Isobutane	1.6	3,252.0	3,000.4	58.12	0.0484	0.07737	157.3	145.1
Pentane	1.4	4,008.7	3,706.9	72.15	0.1105	0.15471	443.0	409.6
Isopentane	1.3	4,000.9	3,699.0	72.15	0.0826	0.10732	330.3	305.4
Hexane	1.1	4,756.0	4,403.8	86.18	0.0411	0.04516	195.3	180.8
Cyclohexane	1.3	4,443.5	4,144.6	84.16	0.0455	0.05918	202.3	188.7
Heptane	1.1	5,502.5	5,100.0	100.20	0.0209	0.02294	114.8	106.4
Octane	1.0	6,248.9	5,796.0	114.23	0.1525	0.15255	953.2	884.2
Benzene	1.2	3,741.9	3,590.9	78.11	0.0302	0.03629	113.2	108.6
2-Methylhexane	1.1	5,454.6	5,055.9	100.20	0.0498	0.05482	271.8	252.0
3-Methylhexane	1.1	5,458.3	5,059.6	100.20	0.0511	0.05618	278.8	258.4
					1.0000	1.56313	4,026	3,729

Mixture MW	**68.00**	**lb/lbmole**
Mixture LEL	**1.56**	**Vol %**
Mixture HHV	**4,026**	**Btu/scf**
Mixture HHV	**22,471**	**Btu/lbm**
Mixture LHV	**3,729**	**Btu/scf**
Mixture LHV	**20,811**	**Btu/lbm**



Key

X $\overline{C_L}$, the lower-explosive-limit concentration parameter for the flare gas, see Equation (C.7)

Y y_c, vertical distance from the stack to flame centre, expressed in feet

[a] $(d_j \cdot R)$ is the parameter for jet thrust and wind thrust, see Equation (C.8).

Figure C.5 — Flame centre for flares and ignited vents — Vertical distance, y_c (USC units)

C.3.4 Calculation of the distance from the flame centre to the object or point being considered

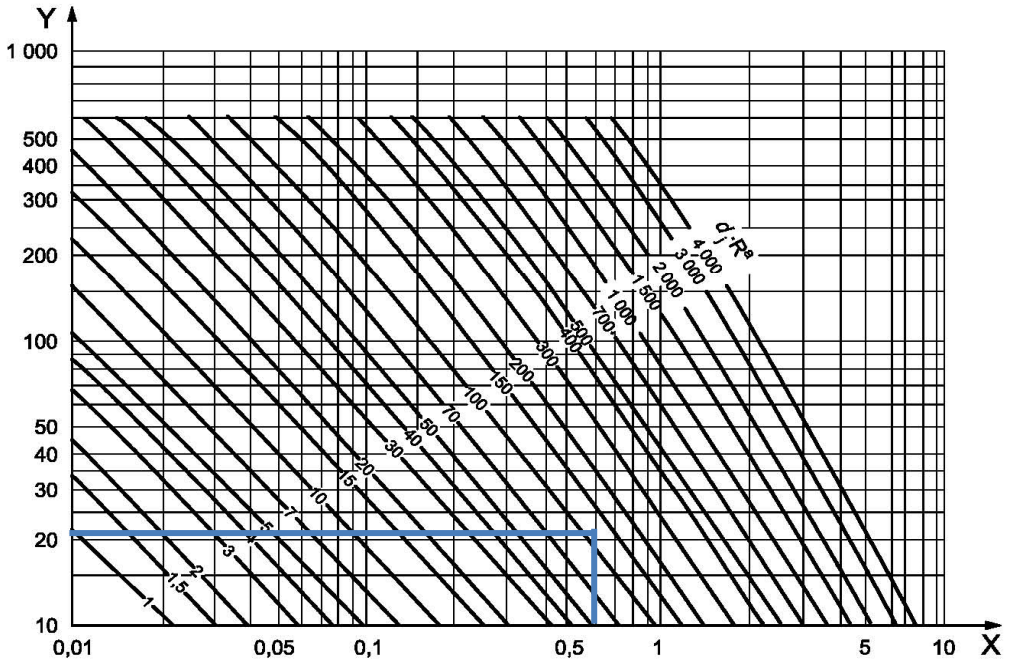
The design basis for this calculation is as follows: The fraction of heat radiated, F, is 0,3. The heat liberated (see C.2.3), Q, is $6{,}3 \times 10^6$ kW ($2{,}15 \times 10^{10}$ Btu/h). Say the flare stack design must limit the maximum allowable radiation (see 6.4.2.3), K, is 9,5 kW/m^2 (3 000 Btu/h·ft^2).

In Equation (24), the value of τ should be assumed to be 1,0 (see C.3.6.3 and C.3.6.4). The distance from the flame centre to the object or point being considered (that is, the distance to the limit of the radiant heat intensity, such as grade level, an equipment platform, or a plant boundary), D, is then calculated as follows:

$$D = \sqrt{\frac{\tau \cdot F \cdot Q}{4\pi \cdot K}} \qquad (24)$$

In SI units:

$$D = \sqrt{\frac{1{,}0 \times 0{,}3 \times 6{,}3 \times 10^6}{4\pi \times 9{,}5}} = 126 \text{ m}$$



Key

X $\overline{C_L}$, the lower-explosive-limit concentration parameter for the flare gas, see Equation (C.7)

Y x_c, horizontal distance from the stack to flame centre, expressed in feet

[a] $(d_j \cdot R)$ is the parameter for jet thrust and wind thrust, see Equation (C.8).

Figure C.3 — Flame centre for flares and ignited vents — Horizontal distance, x_c (USC units)

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-1912**	Type:	Pressure Vessel
Drawing:	D-2415-F-23	MAWP:	250 psig
Description:	Closed Drain Tank	MAWT:	150 F

Scenario Description:

The Closed Drain Tank contains primarily hydrocarbon with some water that could vaporize in the event of an external fire potentially resulting in overpressure. The required relief rate was based on hydrocarbon that is the worst case and the liquids composition from the Condensate Flash Tank was used as the basis at the relief pressure of 302.5 psig. The liquid level of 70% was based on the field estimated location of LSHH-1912.

Scenario Calculation Results:

Required Rate:	130705	lb/hr	Device Choke Pressure:	187.6	psig
Actual Capacity:	61950.8	lb/hr	Outlet Temperature:	347.3	F
Required Area:	6.420	in2	Outlet Mass Quality:	1.000	
Actual Area:	3.043	in2	Outlet Density:	0.122	lb/ft3
Relief Pressure:	302.5	psig	Outlet Ideal Cp/Cv:	1.053	
Relief Temperature:	385.5	F	Outlet Viscosity:	0.010	cP
Relief MW:	72.53		Inlet Non-Recoverble dP:	1.3	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	0.5	% Set
Relief Density:	3.60	lb/ft3	Built-Up Back Pressure:	54.8	psig
Relief SG:	2.501		Built-Up Back P % Set:	21.9	% Set
Relief Z:	0.71		Total Back Pressure:	54.8	psig
Relief Ideal Cp/Cv:	1.05		Total Back P % Set:	21.9	% Set
Relief Viscosity:	0.011	cP			

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-1912**	Type:	Pressure Vessel
Drawing:	D-2415-F-23	MAWP:	250 psig
Description:	Closed Drain Tank	MAWT:	150 F

Scenario Input Data:

Length:	36	ft
Diameter:	131.875	in
Orientation:	Horizontal	
Head Type:	HemiSpherical	
Level Basis:	LAHH-1912	
Additional Wetted Area:	0	ft2
Level:	70%	
Bottom Elevation:	2	ft
Area Exponent:	0.82	
Adequate Drainage	☐	
Insulation Factor:	1	
Start Mass % Vapor:	0.00%	
Finish Mass % Vapor:	5.00%	
Remove Sensible Heat:	☑	
Correct for Densities:	☑	
Set Pressure:	250	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0	psig
Use Thermodynamics:	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.627	
Nozzle Sizing:	API Numerical Integration Vapor	
Outlet Pipe Sizing:	Isothermal	
Notes:		

Scenario Output Data:

Wetted Area:	1049.8	ft2
Fire Heat Input:	10.35	MMBtu/hr
Total Heat/lb Vaporized:	260.0	Btu/lb
Sensible Heat/lb Vaporized:	190.1	Btu/lb
Latent Heat:	69.9	Btu/lb
Initial Relief Temperature:	373.6	F
Temp. at Start Quality:	373.6	F
Cp at Start Quality:	0.795	Btu/lb/F
Cp at Final Quality:	0.804	Btu/lb/F
Liquid Density:	30.56	lb/ft3
Required Mass Rate:	130705.0	lb/hr
Required Std. Vol. Rate:	16.41	MMSCFD
Required Air Rate:	1379117.3	scfh air
Relief Mass Flux:	814.3	lb/sec/ft2

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-1912**	Type:	Pressure Vessel
Drawing:	D-2415-F-23	MAWP:	250 psig
Description:	Closed Drain Tank	MAWT:	150 F

Liquid Stream Description: **Valley Wells Condensate Flash Tank Liquid**

Relief Stream Description: **V-1912 Fire HC Vapor**

Component	Liquid Stream Mole Fraction	Relief Stream Mole Fraction
carbon dioxide	0.0001	0.0004
nitrogen	0.0000	0.0000
methane	0.0050	0.0268
ethane	0.0158	0.0573
propane	0.0478	0.1240
isobutane	0.0250	0.0492
butane	0.0935	0.1672
isopentane	0.0619	0.0829
pentane	0.0883	0.1107
hexane	0.0466	0.0406
benzene	0.0354	0.0299
cyclohexane	0.0611	0.0448
2-methylhexane	0.0722	0.0489
3-methylhexane	0.0757	0.0500
heptane	0.0331	0.0204
octane	0.3385	0.1470

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-1917**	Type:	Pressure Vessel
Drawing:	D-2415-F24A	MAWP:	275 psig
Description:	Condensate Flash Tank	MAWT:	300 F

Scenario Description:

Hydrocarbon liquid could be present and overpressure could occur due to vaporization of the liquid in the event of an external fire. The liquid composition from the Condensate Flash Drum from the MEB was used as the basis with the level at the estimated 70% location of LSHH-1917.

Scenario Calculation Results:

Required Rate:	82727.4	lb/hr	Device Choke Pressure:	206.3	psig
Actual Capacity:	28823.3	lb/hr	Outlet Temperature:	357.8	F
Required Area:	2.620	in2	Outlet Mass Quality:	1.000	
Actual Area:	0.913	in2	Outlet Density:	0.123	lb/ft3
Relief Pressure:	332.8	psig	Outlet Ideal Cp/Cv:	1.051	
Relief Temperature:	400.1	F	Outlet Viscosity:	0.010	cP
Relief MW:	74.07		Inlet Non-Recoverble dP:	2.6	psi
Relief Mass Quality:	1.000		Inlet dP % Set:	1.0	% Set
Relief Density:	4.14	lb/ft3	Built-Up Back Pressure:	44.5	psig
Relief SG:	2.554		Built-Up Back P % Set:	16.2	% Set
Relief Z:	0.67		Total Back Pressure:	44.5	psig
Relief Ideal Cp/Cv:	1.05		Total Back P % Set:	16.2	% Set
Relief Viscosity:	0.011	cP			

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-1917**	Type:	Pressure Vessel
Drawing:	D-2415-F24A	MAWP:	275 psig
Description:	Condensate Flash Tank	MAWT:	300 F

Scenario Input Data:

Length:	40	ft
Diameter:	72	in
Orientation:	Horizontal	
Head Type:	2:1 Ellipsoidal	
Level Basis:	LSHH-1917	
Additional Wetted Area:	16	ft2
Level:	70%	
Bottom Elevation:	4	ft
Area Exponent:	0.82	
Adequate Drainage	☐	
Insulation Factor:	1	
Start Mass % Vapor:	0.00%	
Finish Mass % Vapor:	5.00%	
Remove Sensible Heat:	☑	
Correct for Densities:	☑	
Set Pressure:	275	psig
Allowable Overpressure:	21.0%	
Constant Back Pressure:	0	psig
Use Thermodynamics:	☑	
Thermo Package:	Advanced_Peng-Robinson	
Relief Device Kd:	0.878	
Nozzle Sizing:	API Numerical Integration Vapor	
Outlet Pipe Sizing:	Isothermal	
Notes:	Additional area accounts for the boot.	

Scenario Output Data:

Wetted Area:	546.4	ft2
Fire Heat Input:	6.06	MMBtu/hr
Total Heat/lb Vaporized:	232.0	Btu/lb
Sensible Heat/lb Vaporized:	169.0	Btu/lb
Latent Heat:	63.0	Btu/lb
Initial Relief Temperature:	390	F
Temp. at Start Quality:	390	F
Cp at Start Quality:	0.830	Btu/lb/F
Cp at Final Quality:	0.838	Btu/lb/F
Liquid Density:	29.51	lb/ft3
Required Mass Rate:	82727.4	lb/hr
Required Std. Vol. Rate:	10.17	MMSCFD
Required Air Rate:	871191.7	scfh air
Relief Mass Flux:	1262.8	lb/sec/ft2

External Fire Boiling Liquid API STD 521

Equipment Data:

Equipment Tag:	**V-1917**	Type:	Pressure Vessel
Drawing:	D-2415-F24A	MAWP:	275 psig
Description:	Condensate Flash Tank	MAWT:	300 F

Liquid Stream Description: **Valley Wells Condensate Flash Tank Liquid**

Relief Stream Description: **V-1917 Fire HC Vapor**

Component	Liquid Stream Mole Fraction	Relief Stream Mole Fraction
carbon dioxide	0.0001	0.0004
nitrogen	0.0000	0.0000
methane	0.0050	0.0240
ethane	0.0158	0.0523
propane	0.0478	0.1161
isobutane	0.0250	0.0470
butane	0.0935	0.1613
isopentane	0.0619	0.0820
pentane	0.0883	0.1102
hexane	0.0466	0.0418
benzene	0.0354	0.0308
cyclohexane	0.0611	0.0467
2-methylhexane	0.0722	0.0515
3-methylhexane	0.0757	0.0528
heptane	0.0331	0.0216
octane	0.3385	0.1615

APPENDIX G – Fire Zone Plot Plan

PLANT N

Valley Wells
Fire Zone Map

TK-1182 AMINE
TK-1281 GLYCOL
TK-1981A
TK-1981B
TK-1981C
WATER WELL
LIGHT POLE
FL-1902 LP FLARE
V-1916 LP KO
LIGHT POLE
TK-1985 12,000 GAL. BULLET TANK
RO UNIT
TK-1982 PRODUCED WATER
TK-1981D
TK-1981F
TK-1981E
TK-1181 RAW WATER
TK-1182 RO WATER
TK-1984C SUMP
TK-1984B SUMP
TK-1984A SUMP
LIGHT POLE
LIGHT POLE
N.15+00
N.14+00
GENERATORS
C-1154 TEMP. ACID GAS COMPRESSOR
C-1155 ACID GAS COMPRESSOR
FE-1151 ACID GAS METER
C-1153 FLASH VRU
PK-1951 INSTR. AIR
MCC
MCC BLDG.
AC-0901A/B AMINE AIR COOLER EXCH.
FG SKID NEW
V-1915 SLUG CATCHER/HP INLET SEP.
F-1061 INLET GAS FILTER COALESCER
F-1062 DUST FILTER
H-0501 REBOILER
V-1919 LP FUEL SCRUBBER
PK-1991 GLYCOL STILL OVERHEAD
SULFATREAT
V-1814
V-1813
V-1812
V-1811
V-1912 CLOSED DRAIN TANK
V-1917 CONDENSATE FLASH DRUM
T-1201 GLYCOL CONTACTOR
Zone 2
Zone 3
PK-1191 AMINE REGEN
H-PUMPS
P-1944A
P-1944B
P-1943A
PK-1900 STABILIZER
PK-1200 GLYCOL SKID
LIGHT POLE
FE-1061 METER SKID
T-0702 AMINE AFTER SCR.
FE-1910 FG METER SKID
E-1131 AIR COOLER EXCHANGER
T-0701 AMINE CONTACTOR
V-1210 TEG OVERHEAD SCRUBBER
P-1943B
V-0301 FLASH TANK
P-0601B
P-0601A
EXISTING ROAD
N.13+00
N.12+00
V-1914A UA AIR
V-1914B UA AIR
AIR INTAKE
AIR INTAKE
V-1011 INLET SEPARATOR
TK-1085A LO TANK
TK-1085B LO TANK
C-1051 3616
C-1052 3616
C-1053 3616
C-1054 3606
C-1057 3606
Zone 1
(PH. 3)
(PH. 3)
METERING AREA
FE-1702 LIFT GAS
FE-1701 SALES
FUTURE A.C.E.
FUTURE A.C.E.
E-1051A A.C.E.
E-1051B A.C.E.
E-1052A A.C.E.
E-1052B A.C.E.
V-1010 SLUG CATCHER
LIGHT POLE
LIGHT POLE
N.11+00
N.10+00
V-1920 HP KO
FL-1901 FLARE
E.1+00
E.2+00
E.3+00
E.4+00
E.5+00
E.6+00
E.7+00
E.8+00
E.9+00
E.10+00
N.8+00

Revision A
123
March 2024

Plotted by: ACHURCH Date: 10/26/2021 11:42 AM Drawing: V:\2132 RCE\PLOT PLAN\20-101.dwg

SOUTHCROSS ENERGY

NOTES:

REVISIONS							
1	REVISED PER MOC-20210701-001	AAC	10/6/21	AMB	10/6/21	RK	10/6/21
0	ISSUED FOR CONSTRUCTION	SJH	6/23/21	EWB	6/23/21	–	–
REV.	DESCRIPTION	BY	DATE	CHK	DATE	APPR	DATE

ENGINEERING RECORD					
DRAWN	SM	06/04/14	MECHANICAL	MECH	–
CHECKED	–	–	PIPING	PIPE	–
CLIENT	–	–	CIVIL/STRUCT.	STRUC	–
PROJECT MGMT.	–	–	ELECTRICAL	ELEC	–
PROCESS	PROC	–	INSTR/CONTROL	I&C	–

OVERALL PLOT PLAN
SOUTHCROSS ENERGY
VALLEY WELLS TREATER

SCALE	PROJ. NO.	CITY/COUNTY, STATE	DWG. NO.	REV
N/A	–	COTULLA, TX	4029-20-101	1