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April 20, 2020

ESDR-143-20  
 02-E-01-B

**Via E-Mail at Compliance@BAAQMD.gov**

Mail Stop FM1  
 Bay Area Air Quality Management District  
 939 Ellis Street  
 San Francisco, CA 94109

**Subject: Determination and Reporting of Cause:  
 Main Flare (S-296) March 5, 2020  
 BAAQMD 12-12-406 & Consent Decree 167 – 169  
 Phillips 66, San Francisco Refinery (Plant 16)**

As required by BAAQMD 12-12-406 and the Phillips 66 Consent Decree, a Causal Analysis was conducted on the following hydrocarbon flaring incident. A Causal Analysis is required when the volume flared exceeds 0.5 MMSCF or sulfur dioxide emissions are greater than 500 pounds. The flaring occurred intermittently on March 5, 2020 from approximately 6:18 a.m. until 8:24 a.m. There was additional, related intermittent flaring on March 5, 2020 from 1:23 p.m. until 1:29 p.m. and on March 6, 2020 from 3:27 a.m. until 5:12 a.m. The report contents are based on requirements of the Phillips 66 Consent Decree (CD) and the BAAQMD June 25, 2007 Compliance Advisory (BCA) and are referenced as such.

- The BAAQMD and Consent Decree 500 lb SO<sub>2</sub> report threshold was exceeded.
- The BAAQMD 500,000 scf/calendar day flow threshold was not exceeded.

**Total Volume and Emissions from Affected Flares [BCA 4, 5, 8, 9; CD 153(a) & (b)]:**

Refinery Main Flare (S-296):

Date/Flare	Start Time	End Time	Duration (Hrs:Min)	Gas Flow Rate, MSCF	Avg. H <sub>2</sub> S Mole	SO <sub>2</sub> , lb	CH <sub>4</sub> , lb	NMHC, lb
3/5/2020	6:18 AM	1:29 PM	2:12	176	2.18%	640	25	127
3/6/2020	3:27 AM	5:12 AM	1:45	32	1.42%	75	7	16
<b>Totals</b>			<b>3:57</b>	<b>208</b>		<b>715</b>	<b>32</b>	<b>143</b>

SO<sub>2</sub> emissions are calculated using the following equation:  
 $SO_2 \text{ (lb)} = (FR) * (H_2S \text{ conc.}) * (0.1689)$   
 FR = total flow rate during flaring, scf  
 $0.1689 = [lb\text{-mol } H_2S / 379 \text{ scf } H_2S] * [64 \text{ lb } SO_2 / \text{mol } H_2S]$

Flaring Event Description [BCA 6, 7, 10, 11]

On March 5, 2020 a voltage sag occurred in the third-party power supply. This resulted in flaring due to the loss of compressors and other major pieces of equipment. In addition, several process units were impacted by the voltage sag. The Unit 246 Hydrocracker shut down following the voltage sag. Flaring occurred after the voltage sag due to the unit and electrical impacts. Additional flaring occurred the following day due to a unit startup.

Primary Cause and Contributing Factors [BAAQMD 12-12-406.1, BCA 11, CD 153(d):

At approximately 6:18 a.m. on March 5 a significant voltage sag occurred in the electricity supplied by the third-party supplier. Site equipment including some major compressors shut down due to the voltage sag, which resulted in one unit shutting down and other units temporarily operating in an upset condition.

In this case, the voltage sag was significant enough that a number of the motors at the refinery shut down. The most significant motors affected by this voltage sag include the Steam Power Plant G-17 Fuel Gas Compressors, the Unicracker Unit 248 G-602 Hydrogen Make-Up Compressors, and the Unit 246 G-803 A/B Hydrogen Make-up compressors.

Flaring initially began due to the shutdown of the compressors noted above. Unit 246 shut down due to the loss of the G-803 A/B Hydrogen Make-Up compressors. Flaring continued due to the Unit 246 shutdown and associated unit upsets until steady unit operation was restored. There were some periods of fuel gas imbalance due to the unit upsets that also resulted in flaring. There was flaring the following day that was associated with the Unit 246 startup.

During the Unit 246 shutdown a number of steps were taken to move the unit into a safe state. This included sending products to off-grade rather than to product tankage. One of the moves was to put the Unit 246 D-803 Hydrogen Sulfide (H<sub>2</sub>S) Stripper Overhead liquid to the flare blowdown system. This resulted in higher-than-normal sulfur content in the gas that is normally recovered by the flare gas recovery compressors. Unscrubbed material was sent to the flare due to the shutdown of various equipment and on-going flaring in conjunction with sending the Unit 246 D-803 stripper material to blowdown.

The third-party power supplier reported that a B-phase to Ground Fault occurred. This occurred on the Oleum-North Tower-Christie 115kv line. The fault occurred near the Martinez Junction towards the North Tower sub section of the line. From a helicopter patrol the third-party found flashed insulators on structure 3/21 (all three phases) and also found dirty insulators on 3/23. The weather was foggy at the fault location.

Measures to Limit Duration/Quantity [BCA 10, 11, 12, CD 153(c)]

Unit operations were restored at approximately 8:24 a.m. on March 5, 2020 and the majority of the flare activity ceased. There was brief flaring on March 6, 2020 during Unit 246 startup.

Prevention Measures [BAAQMD 12-12-406.2, BCA 16, CD 153(e) & 154]:

The primary cause of this flare activity was due to the voltage sag in the electricity supplied by the third-party utility supplier.

Phillips 66 has met with the third-party power supplier about this ground fault and additional power dips of lesser magnitude. Phillips 66 has engaged the third-party and has requested that its standard preventative maintenance practices be shared with Phillips 66. Phillips 66 is also in communication with the supplier on potential future capital projects for improving electrical supply reliability for lines that supply electricity to the refinery.

The following site preventative measures have been identified:

Root Cause Finding	Action Item(s)	Date
Third Party Power Supply Voltage Sag	1. Phillips 66 has engaged the third-party and has requested that its standard preventative maintenance practices be shared with Phillips 66. Phillips 66 is also in communication with the supplier on future capital projects for improving electrical supply reliability for lines that supply electricity to the refinery.	COMPLETED March 20, 2020 & on-going
Routing of Unit 246 D-803 H <sub>2</sub> S Stripper overhead liquid to blowdown	2. Update procedure to keep U246 D-803 H <sub>2</sub> S Stripper overhead on-grade to Unit 240 Plant 3 at lower process rates before routing this stream to blowdown.	Target July 1, 2020

Was the Flaring the Result of an Emergency [BAAQMD 12-12-406.4, BCA 13]:

No.

Was flaring due to a Regulatory Mandate to Vent to a Flare [BAAQMD 12-12-406.4, BCA 15]:

No.

Consistency with Flare Minimization Plan (FMP) [BAAQMD 12-12-406.3, BCA 14]:

The activities described that resulted in flaring are consistent with activities included in the Flare Minimization Plan. Specifically, these activities can be found described in the FMP in more detail in Section 4.2 as described below:

- Upset/Malfunction (4.2.1.4) – Loss of a Utility

Please contact Jennifer M. Ahlskog at (510) 245-5856 if you have any questions.

Sincerely,



Brent P. Eastep  
Environmental Team Lead

Attachment

PFD Refinery Flare & Blowdown System (RVR-ENVRNM-YF-FLRE-001)

cc:

Chris Crowley – BAAQMD, via e-mail: [CCrowley@baaqmd.gov](mailto:CCrowley@baaqmd.gov)  
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**200:G-540A/B/C**  
FLARE GAS VAPOR RECOVERY COMPRESSORS  
DESIGN: 254 S27M 100 PSI AP  
DRIVER: 600 HP @ 1180 RPM  
SP. GR. 1.0  
LIQUID RING

**200:F-540**  
SERVICE LIQUID SEPARATOR  
SIZE: 72" O.D. x 20'-0" S/S  
DESIGN: 150 PSIG @ 550° F  
(V @ 300° F)

**200:F-509**  
LOW PRESSURE SEPARATOR  
SIZE: 30" O.D. x 10'-0" S/S  
DESIGN: 275/-15 PSIG @ 100° F  
INSULATION: NONE

**200:GG-503**  
VAPOR RECOVERY COMPRESSOR  
DESIGN: 3300 S27M 165 PSI AP  
DRIVER: 1000 HP @ 16 RPM  
SP. GR. 1.0

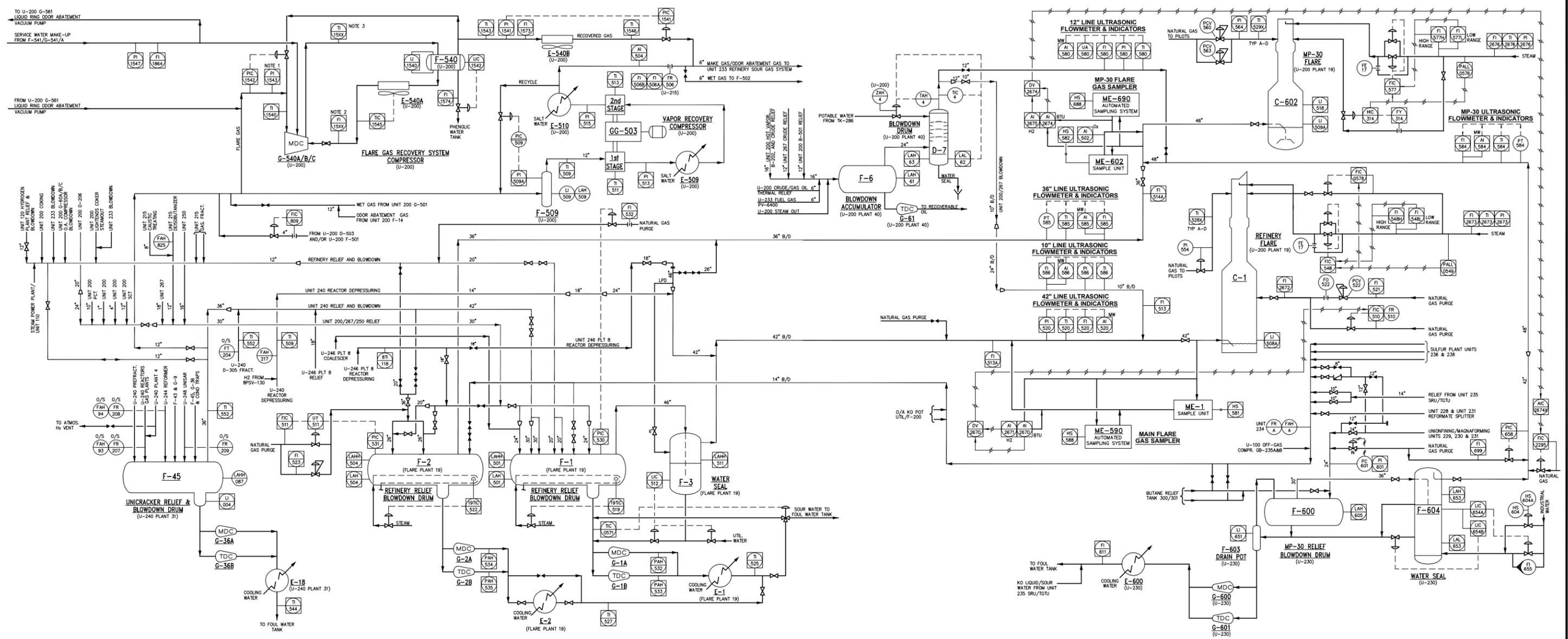
**200:40F-6**  
BLOWDOWN ACCUMULATOR  
DIAMETER (INCHES): 114 ID x 20'-0" T/1  
DESIGN: 15 PSIG @ 900° F  
INSULATION (INCHES): 3" PP

**200:40D-7**  
BLOWDOWN DRUM  
DIAMETER (INCHES): 114 ID x 32'-0" T/1  
DESIGN: 15 PSIG @ 900° F  
INSULATION (INCHES): 3" PP

**200:19C-602**  
MP-30 ELEVATED FLARE  
WATER SEAL DRUM  
FLARESTACK  
DESIGN: 15 PSIG @ 550° F  
INSULATION: NONE

**200:19C-1**  
REFINERY FLARE  
WATER SEAL DRUM  
FLARESTACK  
DESIGN: 15 PSIG @ 500° F  
INSULATION: NONE

**200:40G-61**  
BLOWDOWN DRUM  
PUMP-OUT  
DESIGN: 200 GPM @ 107 PSI AP  
DRIVER: 50 HP @ 3600 RPM  
SP. GR. 1.0



**240:31F-45**  
RELIEF & BLOWDOWN DRUM  
DIAMETER (INCHES): 132 ID x 30'-0" S/S  
DESIGN: 50 PSIG @ 650° F / 20 PSIG @ -50° F  
INSULATION (INCHES): NONE

**240:31E-18**  
PUMP-OUT COOLER  
DESIGN: 400 GPM @ 78 PSI AP  
DRIVER: 60 HP @ 3600 RPM  
SP. GR. 0.58 @ 50° F HC  
&/OR 1.0 @ 650° F

**200:19F-2**  
REFINERY RELIEF BLOWDOWN DRUM  
DIAMETER (INCHES): 11 ID x 30'-0" T/1  
DESIGN: 25 PSIG @ 650° F / 10 PSIG @ -50° F  
INSULATION (INCHES): NONE

**200:19E-2**  
PUMP-OUT COOLER (OUT OF SERVICE)  
DESIGN: 6.7 MM BTU/HR (DESIGN)  
DESIGN: (SHELL) 150 PSIG @ 250° F  
DESIGN: (TUBE) 200 PSIG @ 350° F  
INSULATION (INCHES): NONE

**200:19F-1**  
REFINERY RELIEF & BLOWDOWN DRUM  
DIAMETER (INCHES): 15.5 ID x 40'-0" T/1  
DESIGN: 25 PSIG @ 650° F / -15 PSIG @ 500° F / 10 PSIG @ -50° F  
INSULATION (INCHES): NONE

**200:19F-3**  
WATER SEAL DRUM  
DIAMETER (INCHES): 6.7 MM BTU/HR (DESIGN)  
DESIGN: (SHELL) 150 PSIG @ 250° F  
DESIGN: (TUBE) 204 PSIG @ 350° F  
INSULATION (INCHES): NONE

**230:E-600**  
BLOWDOWN SLOPS COOLER  
MM BTU/HR (DESIGN)  
DESIGN: (SHELL) 150 PSIG @ 500° F  
DESIGN: (TUBE) 150 PSIG @ 500° F  
INSULATION (INCHES): NONE

**230:F-603**  
DRAIN POT  
DIAMETER (INCHES): 60 OD x 8'-0" S/S  
DESIGN: 150 PSIG @ 500° F  
INSULATION (INCHES): NONE

**230:F-600**  
KNOCKOUT DRUM  
DIAMETER (INCHES): 120 ID x 29'-5" S/S  
DESIGN: 28 PSIG @ 500° F  
INSULATION (INCHES): NONE

**230:F-604**  
WATER SEAL  
DIA. (INCHES): 144 OD x 32'-6" S/S  
DESIGN: 50 PSIG @ 650° F  
INSULATION (INCHES): NONE

**240:31G-36A**  
PUMP-OUT  
DESIGN: 400 GPM @ 78 PSI AP  
DRIVER: 60 HP @ 3600 RPM  
SP. GR. 0.58 @ 50° F HC  
&/OR 1.0 @ 650° F

**200:19G-2A**  
PUMP-OUT  
DESIGN: 200 GPM @ 107 PSI AP  
DRIVER: 60 HP @ 3600 RPM  
SP. GR. 0.61 @ 450° F

**200:19G-1A**  
PUMP-OUT  
DESIGN: 200 GPM @ 107 PSI AP  
DRIVER: 50 HP @ 3600 RPM  
SP. GR. 0.61 @ 450° F

**200:19E-1**  
PUMP-OUT COOLER  
DESIGN: 6.7 MM BTU/HR (DESIGN)  
DESIGN: (SHELL) 150 PSIG @ 250° F  
DESIGN: (TUBE) 204 PSIG @ 350° F  
INSULATION (INCHES): NONE

**230:G-600**  
BLOWDOWN SLOPS PUMP  
DESIGN: 150 ACFM @ 150 PSI AP  
DRIVER: 25 HP @ 1770 RPM  
CASE 1: SP. GR. 1.0 @ 60° F  
CASE 2: SP. GR. 0.63 @ 250° F

**230:G-601**  
BLOWDOWN SLOPS PUMP (SPARE)  
DESIGN: 150 ACFM @ 150 PSI AP  
DRIVER: 25 HP @ 1770 RPM  
CASE 1: SP. GR. 1.0 @ 60° F  
CASE 2: SP. GR. 0.63 @ 250° F

**NOTES:**  
1. NORMAL OPERATION  
GG-503 & G-561 PLUS ONE ONLY G-540 IS IN SERVICE  
ALTERNATE OPERATION  
G-540A, B & C IS IN SERVICE  
GG-503 & G-561 OUT OF SERVICE

**240:31G-36B**  
PUMP-OUT (SPARE)  
DESIGN: 400 GPM @ 78 PSI AP  
DRIVER: 60 HP @ 3600 RPM  
SP. GR. 0.58 @ 50° F HC  
&/OR 1.0 @ 650° F

**200:19G-2B**  
PUMP-OUT  
DESIGN: 200 GPM @ 107 PSI AP  
DRIVER: 60 HP @ 3600 RPM  
SP. GR. 0.61 @ 450° F

**200:19G-1B**  
PUMP-OUT  
DESIGN: 200 GPM @ 107 PSI AP  
DRIVER: 50 HP @ 3600 RPM  
SP. GR. 0.61 @ 450° F

**SIMPLIFIED PROCESS FLOW DIAGRAM  
REFINERY FLARE & BLOWDOWN SYSTEM  
RELIEF, BLOWDOWN  
VAPOR RECOVERY, & FLARE**

REFERENCE FILE (XREF) FOR THIS DRAWING IS  
FLRE-YF-001-001 & FLRE-YF-001-002

REV	DATE	DESCRIPTION	SFE NO.	BY	CHKD	APPRD	DATE
8	12-17-19	AS BUILT, PROJECTS MODIFIED PER SFE 13109 & SFE	17068	LMB	MM	ASM	11-19
7	7-19-19	AS BUILT, MODIFIED INSTRUMENTATION PER SFE	17068	MM	MM	ASM	7-19-19
6	1-16-19	AS BUILT, ADDED INSTRUMENTATION PER SFE	17068	MM	LMB	ASM	1-16-19

DRAWING NUMBER	REV
RVR-ENVRNM-YF-FLRE-001	8



FILE: RVR-ENVRNM-YF-FLRE-001.dwg  
REV: 8  
DATE: 12-17-19