

PHILLIPS 66
SAN FRANCISCO REFINERY
 1380 San Pablo Avenue
 Rodeo, CA 94572



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December 29, 2021

ESDR-482-21
 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) November 11, 2021
 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 on November 11, 2021 from approximately 12:20 PM until 2:08 PM. 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 SO₂ 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	H ₂ S %	SO ₂ , lb	CH ₄ , lb	NMHC, lb
11/11/2021	12:20 PM	2:08 PM	1:48	395	9.69	6,352	135	239

SO₂ emissions are calculated using the following equation:

$$\text{SO}_2 \text{ (lb)} = (\text{FR}) * (\text{H}_2\text{S conc.}) * (0.1689)$$

FR = total flow rate during flaring, scf

$$0.1689 = [\text{lb-mol H}_2\text{S}/379 \text{ scf H}_2\text{S}] * [64 \text{ lb SO}_2/\text{mol H}_2\text{S}]$$

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

Flaring occurred at the Main Flare (S296) on November 11, 2021, for approximately 1 hour and 48 minutes from 12:20 P.M. until approximately 2:08 P.M. due to a Sulfur Recovery Unit (SRU) Complex upset. In response to this event the Refinery emergency sulfur plant shutdown procedure (REOP-10) was implemented to initiate operational changes to minimize impact. One of the elements of this procedure is to circulate the Flare Gas Recovery Compressors (FGRCs) which resulted in flaring of unscrubbed gas. During the flare activity there was also a period of uncertified

observations of the flare which indicated the presence of visible emissions. The flare visible emissions occurred from approximately 12:31 P.M. until 1:45 P.M.

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

On November 11, 2021, at 11:43 AM, Sulfur Recovery Units U236 and U235 experienced process upsets. The two SRU's experienced a sudden high level in the furnace inlet knock out (KO) pots which initiated the safety shutdown. High level KO pot trip is a protective safety shutdown function that prevents liquid going to the reactor furnaces and causing flame out.

Prior to the event, the primary amine flash drum (F-809) located at Unit 235 was switched to a spare flash drum (F-803) for scheduled regulatory internal inspection of the primary flash drum (F-809). Both drums are designed with an overflow weir to separate oil from amine. On the day of the event, the level indicator (LIT-801) on the spare flash drum failed, resulting in spare drum (F-803) reaching a high level and sending oil to the downstream Amine Regenerators. The source of contamination is the amine flash drum (F-803) where the level transmitter (LIT-801) failed, and oil/ hydrocarbon was carried over on the Rich Amine side. Oil carried over from F-803 causing foaming in the Amine Regenerators, that resulted in high liquid levels in the reflux drums and SRUs (U235 & U236) knock out pots. High levels on the knockout pots tripped the SRU complex furnaces as designed per safety system protection. The shutdown of the furnaces is a safety shutdown system to prevent liquid carryover into the Claus reactors and sour gas through the unit to accumulate and cause further upset conditions. The shutdown of the SRUs led to untreated sour vent gas to the enclosed flare header and to be subsequently combusted at the flare.

Measures to Limit Duration/Quantity [BCA 10, 11, 12,]

The Refinery emergency SRU shutdown procedure was implemented to initiate operational changes to minimize impact of this event. Refinery unit throughputs were reduced to minimize sour gas flaring. The Flare Gas Recovery Compressors (FGRCs) were circulated and put on standby to prevent sour gas from combusting at the site heaters. Standby condition of FGRCs allowed for FGRCs to be returned to service in a rapid manner. Sour water strippers were shut down and sour water redirected to sour water tanks to reduce sour gas flow.

Liquid levels from reflux drums, amine header and knock-out pots were immediately drained to blowdown using all available drain pumps. The sulfur recovery units were stabilized at 1:32 pm and flaring stopped at 2:08 pm. During this event no excess emissions were detected by the Ground Level Monitoring (GLM's) or the fenceline monitoring system.

Immediately after the event, the level indicator was inspected by maintenance and confirmed that level indication (LIT-801) had failed. Upon identification of the level indication failure, the pneumatic level indicator at the spare drum was replaced with an electronic differential pressure level indicator.



Prevention Measures [BAAQMD 12-12-406.2, BCA 16.1]:

The following root cause and corrective actions identified:

Root Cause Finding	Action Item(s)	Date
Amine flash drum F-803 level indicator LIT-801 failed.	Upon identification of the level indication failure, the pneumatic level indicator at the spare drum was replaced with an electronic differential pressure level indicator	COMPLETED 11/12/21
	Revise Procedure RD-U236-NOP-921 "Amine Flash Drum F-809 Remove from Service" to include enhanced monitoring of Amine and oil side while in F-803 service.	COMPLETED 12/17/21

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

Yes.

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)- Failure of instrumentation, valve, pump, compressor, etc. to function as designed.

Please contact Andrea Fabio at (510) 245-4635 if you have any questions.

Sincerely,



Andrea Fabio for Jennifer Ahlskog
Environmental Team Lead

Attachment

PFD Refinery Flare & Blowdown System (RVR-ENVRNM-YF-FLRE-001)
P&ID Unit 236 Amine Regeneration Amine Flash Drums (0236-YD-003-001)

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