



NEKO

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November 8, 2019

ESDR-355-19  
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) September 25, 2019  
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 September 25, 2019 from approximately 9:56 AM until 6:58 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.

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. S Mole	SO <sub>2</sub> , lb	CH <sub>4</sub> , lb	NMHC, lb
9/25/19	09:56 AM	06:58 PM	9:02	1,983	2.15%	7,082	511	1,474
<b>Totals</b>			<b>9:02</b>	<b>1,983</b>		<b>7,082</b>	<b>511</b>	<b>1,474</b>

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

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

At approximately 9:56 AM on September 25, 2019 the G-501 Wet Gas Compressor (G-501) experienced an unplanned shutdown. Following the G-501 shutdown, the gas from the Unit 200 Bubble Tower, which is normally recovered by G-501, was subsequently relieved to the refinery flare gas recovery system (FGRS). Due to the excess gas normally recovered by G-501, the FGRS could not recover the additional process gas resulting in flaring of unscrubbed gas. Per site procedures, steps were taken to put the G-503 flare gas recovery compressor in G-501 Wet Gas Recovery Compressor (WGC) service in order to reduce flow to the flare. Due to challenges in returning G-501 WGC to service it was determined to shut the Unit 200 Coker process unit down to cease flaring rather than further wait for the G-501 WGC operation to be restored. Flaring stopped at 6:58 PM when the G-503 flare gas recovery compressor was returned back into flare gas recovery service.

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

The primary cause of the flaring was the unscheduled shutdown of G-501, which caused excess gas to be sent to the FGRS. The amount of gas being sent to the FGRS exceeded the recovery capacity of the system and the excess was flared.

Upon investigation, it was discovered that the G-501 Wet Gas Compressor shutdown due to a motor high amperage (AMPs) safety shutdown activation. Motor AMPs are an indication of load being pulled on a compressor.

During the previous shift, the Unit 200 Coker was operating on only one side, B side. At that time the G-501 Wet Gas Compressor spillback was placed in manual mode to allow the G-501 Wet Gas Compressor to operate at reduced gas recovery load. On the morning of September 25, 2019, the A side of the Unit 200 Coker was being placed back into service. The unit operator had not been made aware the compressor had been previously placed in manual. As feed to the A side of the U200 Coker was being introduced the G-501 WGC began to load up with additional Wet Gas being produced. The G-501 WGC spillback is not normally in manual mode when the Coker is operating both sides, A and B. The G-501 compressor received a high AMP alarm. Soon after the high AMP alarm, the G-501 WGC shutdown due to a high AMP motor protective shutdown function.

During the investigation it was identified that prior to this incident the high motor AMP alarm had been periodically triggered. The high motor AMP alarm set point led to the alarm triggering relatively frequently without consequence to the motor and had become normal for operations. In this incident no actions were taken to respond to the motor AMP alarm during the A side Coker startup. There was not heightened awareness that this AMP alarm may indicate G-501 shutdown nor that the compressor may be operating in an abnormal mode of operation.

An additional finding of the investigation is that upon the initial shutdown of the G-501 compressor it would not immediately restart. It was found the starter electrical connections were bad which prevented rapid restart. The cause of the bad electrical connection is unknown, but it is potentially due to high AMP operation or some issue that occurred following the November 2018 startup following unit turnaround. Repairing the electrical connection took time to resolve which delayed the G-501 restart. Ultimately, Unit 200 was shutdown while the electrical connection issue was resolved.

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

The G-501 WGC was attempted to be started up but experienced an electrical failure. The third G-540 flare gas recovery compressor was put into service, previously two of the three had been operating. The process to put G-503 flare gas recovery compressor into G-501 service was initiated. The B-side of the Unit 200 was put in circulation to reduce flare load. Unit rate at one of the other refinery units was reduced to further lower the load to the flare. Due to challenges with getting the G-501 WGC started back up, the decision was made to shut the Unit 200 Coker process unit down until the G-501 WGC could undergo further electrical starter repairs. The G-503 FGRS was returned from G-501 WGC service to FGRS.

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

The following preventative measures have been identified:

Root Cause Finding	Action Item(s)	Date
G-501 WGC spillback in manual mode not communicated between shifts	Identify and enhance means to communicate unusual modes of operation for critical controllers, such as WGC spillback in manual.	Target 3/1/2020
G-501 electrical starter failure delayed G-501 startup	Replace components of the electrical starter to allow G-501 to restart.	<b>COMPLETED 9/25/2019</b>
G-501 High Motor AMP Alarm did not provide awareness of potential G-501 SD	Review and update the G-501 Reliability Operating Limit and Independent Protective Layer alarm set points to ensure proper notification of potential equipment shutdown.	<b>COMPLETED 9/26/2019</b>

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 – Loss of major compressor, G-501 Wet gas Compressor (4.2.1.4)

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

Sincerely,



Brent P. Eastep  
Environmental Team Leader

Attachment

PFD Refinery Flare & Blowdown System (RVR-ENVRNM-YF-FLRE-001)  
PFD U200 Coking Section (0200-YF-002-002) Confidential

cc:

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