April 29, 2022

Via E-Mail at Flares@BAAQMD.gov

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

Subject: Determination and Reporting of Cause:
MP-30 Flare (S-398) February 23, 2022
BAAQMD 12-12-406
Phillips 66, San Francisco Refinery (Plant 16)

As required by BAAQMD 12-12-406 a Causal Analysis was conducted on the following flaring incident. A Causal Analysis is required when the volume flared exceeds 0.5 MMSCF or sulfur dioxide emissions are greater than 500 pounds. Flaring occurred from February 23, 2022, at 4:30 p.m. to 7:02 p.m. The report contents are based on requirements of the BAAQMD June 25, 2007, Compliance Advisory (BCA) and are referenced as such.

- The BAAQMD and Consent Decree 500 lb SO$_2$ report threshold was not exceeded.
- The BAAQMD 500,000 scf/calendar day flow threshold was exceeded on January 13, 2022.

Total Volume and Emissions from Affected Flares [BCA 4, 5, 8, 9]:

Refinery MP-30 Flare (S-398):

<table>
<thead>
<tr>
<th>Date/Flare</th>
<th>Start Time</th>
<th>End Time</th>
<th>Duration (Hrs:Min)</th>
<th>Gas Flow Rate, MSCF</th>
<th>Avg. H$_2$S Mole %</th>
<th>SO$_2$, lb</th>
<th>CH$_4$, lb</th>
<th>NMHC, lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/23/22</td>
<td>4:43 P.M.</td>
<td>7:02 P.M.</td>
<td>2:19</td>
<td>781</td>
<td>0.01%</td>
<td>13</td>
<td>325</td>
<td>52.8</td>
</tr>
</tbody>
</table>

SO$_2$ emissions are calculated using the following equation:

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

FR = total flow rate during flaring, scf
$0.1689 = \frac{[\text{lb-mol H}_2\text{S}/379 \text{ scf H}_2\text{S}]}{[84 \text{ lb SO}_2/\text{mol H}_2\text{S}]}$

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

On February 23, 2022, there were periods of intermittent flaring at the MP-30 flare (S398) for approximately 2 hours and 19 minutes (from 4:43 p.m. until approximately 7:02 p.m.) due to a Unicracker Complex upset. During this upset there was also flaring at the Main Flare (S296). No BAAQMD 12-12 thresholds were exceeded for the Main Flare. There was a period of smoking from the Main Flare that was reported as a Title V deviation. During flare activity at the MP-30 Flare unscrubbed gases were directed to the flare and bypassed the flare gas recovery system.
Primary Cause and Contributing Factors [BAAQMD 12-12-406.1, BCA 11]

On February 23, 2022, there were periods of intermittent flaring at the MP-30 flare (S-298) due to a Unicracker Complex upset. Unit 246, Unit 244, and Unit 250 were impacted by this upset. The primary cause of the upset was activation of a safety system at Unit 246 located at the Unicracker Complex. The safety system was activated due to an abnormal differential bed temperature reading on the unit reactors. The difference in bed temperature triggered the safety system to open the depressurizing valve to the flare. The cause of the abnormal differential temperature reading occurred within a software component that is used to transfer temperature data to the Distributed Control System (DCS). Due to the data transfer anomaly a false bed differential temperature indication occurred. This then activated the unit safety system based on a false temperature differential indication. Unscrubbed gases were sent to the flare during this upset.

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

Troubleshooting was undertaken to identify the initial cause of the unit upset and to mitigate flare activity.

Prevention Measures [BAAQMD 12-12-406.2, BCA 16]:

The following root cause and corrective actions were completed:

<table>
<thead>
<tr>
<th>Root Cause Finding</th>
<th>Action Item(s)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redundant software connection falsely indicated abnormal temperature differential.</td>
<td>Remove redundant software connected temperature signal to minimize possibility of corrupted data transfers. Hardwire only temperature indication was retained for safety system initiation.</td>
<td>COMPLETED 2/25/2022</td>
</tr>
</tbody>
</table>

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:

Equipment failure which results in an immediate or controlled unit shutdown –
Upset/Malfunction (Section 4.2.1.4)

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

Sincerely,

Jennifer Ahlskog
Environmental Team Lead

Attachment

PFD Refinery Flare & Blowdown System (RVR-ENVYRM-YF-FLRE-001)
P&ID Unit 246 Hydrotreating Reactor (246-YD-001-018 and 246-YD-001-019)

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