Widespread corrosion at the Richmond Refinery

This page: The pipe that ruptured in Chevron’s disastrous August 2012 fire (point 1 below) is just one of at least twenty known places where corrosion damaged equipment in its crude unit alone. Next page: Corrosion attacks process equipment refinery-wide.

1. #4 sidecut pipe from atmospheric column C-1100 to pumps P-1149/A: sulfidation corrosion leads to rupture in Aug. 2012 fire

2. Atmospheric overhead pipe from C-1100 to relief header: extensive internal corrosion pitting, found after fire-damaged pipe was removed, suggests a failure risk before the next scheduled maintenance shutdown

3. Atmospheric column C-1100 shell: corrosion under insulation

4. Atmospheric column C-1100 pressure taps PT 001 & 003: internal pitting corrosion

5. Atmospheric reflux drum V-1100 shell: internal corrosion

6. Condensate pipe downstream from vessel V-1164: internal & external corrosion & leaks

7. C-1100 crude feed pipe from furnaces F-1100A/B: internal weld corrosion after repair from naphthenic acid corrosion

8. Relief piping for atmospheric reflux drum V-1100: 43% of pipe wall is lost to external crevice corrosion

9. Smothering steam piping for furnace F-1160 firebox: localized corrosion found since 2006

10. #7 sidecut pipe from pumps P-1179 & 1189A to exchanger E-1109: sulfidation corrosion repairs

11. Atm. overhead pipe from E-1101 to condenser: external corrosion pitting

12. Atm. overhead pipe from E-1100 to V-1100: extensive internal corrosion pitting, found after fire-damaged pipe removed, suggests a failure risk before the next scheduled shutdown

13. FT-007 tubing between reflux drum V-1100 & exchanger E-1100: corrosion at compression fitting

14. Stripping steam pipe to atm. column C-1100: corroded & leaking

15. Reflux drum V-1100 pH sample pipe & tubing: repeated plugging suggests corrosion upstream

16. Stripping steam piping to column C-1130: corrosion under insulation thins pipe to 50% of recommended replacement thickness

17. Aqueous ammonia tank TK-1108: underside & internal corrosion

18. Atm. overhead pipe from C-1100 to E-1101: external corrosion, bulging & delamination

19. Medium-pressure condensate header piping: corrosion under insulation

20. Condensate pipe adjacent to C-1100 & pumps P-1105/A: corrosion under insulation

The small red box in this map of Richmond refinery processing areas shows the crude unit areas in the detailed blow-up above.

Continued next page...
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The extensive corrosion documented above represents only a partial sample in a small part of the refinery. Chevron reported those data publicly only for crude unit equipment it sought permits to replace or repair after its August 2012 fire (1–20). And some serious corrosion damage was found only after fire-damaged equipment was dismantled and easier to inspect (e.g., 2, 12).

Corrosive chemicals—such as hydrogen sulfide formed in high-temperature processing of oil feedstock that is contaminated by sulfur—can attack processing equipment refinery-wide.

Workers “downstream” from the Richmond crude unit warned in 2011 that Chevron was ignoring widespread and accelerating corrosion following its switch to higher sulfur crude oils (21). At the Richmond lube oil processing area alone (see the black rectangle in the map above), the refinery workers identified at least seven examples of corrosion-damaged equipment:

- Accelerating internal corrosion of the V-1410 High Pressure Separator process vessel;
- Internal corrosion damage of the Column C-1500 process vessel and trays;
- Corrosion and cracking of the Column C-1500 impingement plate and cladding;
- Plugging of the Column C-1500 sidecuts by corrosion products (“scale”);
- Corrosion damage in Vessel V-1110, which is upstream of Column C-1200;
- Plugging of the Column C-1200 reboilers by corrosion products (scale); and
- A corroded furnace tube elbow failed in a fire at Heavy Neutral Cracker Furnace F-1551 (21).

Refiners can install clamps on corroded pipes to stop leaks as a temporary stop-gap measure. Reported data on this practice at Richmond reveals a refinery-wide corrosion problem:

- Refinery-wide, Chevron relied on as many as 2,000 of these temporary clamps in 2012 (22).
- Cal-OSHA inspected a portion of these temporary clamps and cited Chevron for relying on at least nine of these clamps long after the corroded equipment should have been replaced (23).

Ignoring worsening corrosion greatly increases catastrophic incident risk refinery-wide.

References for points of corrosion damage in the Richmond refinery Crude Unit:

Reference for points of corrosion damage in the Richmond refinery Lube Processing Area:

References for clamps on corroded piping at Richmond refinery-wide:
(22) Garrett Brown, Senior Safety Engineer & Special Assistant to the Chief, Cal-OSHA, personal communication with Greg Karras, CBE, on 31 January 2013. (23) Cal-OSHA, 2013. Inspection 314332370 (Citation 8 Item 1).