



LEGEND

- Refer to Chevron Interim Investigation Report
- Refer to Chevron Regulatory Report
- Refer to Chevron Final Investigation Report

GOVERNMENT

INDUSTRY CODES AND STANDARDS

CHEVRON

PHYSICAL EVENTS AND CONDITIONS

OUTCOME

No requirement for ALARP

Essential process safety analyses not required by regulator

Regulatory regime reactive and activity-based rather than goal-based

Regulators had little input into safety precautions in the refinery.

Regulator does not require or oversee safety culture assessment follow-up action items

API does not require 100% component inspection

Inconsistent API standards

Minimal industry emergency leak response protocol requirements

Thorough inherently safer systems analysis not conducted in PHA

Thorough safeguard evaluation not conducted in PHA

No Damage Mechanism Hazard Review performed

No formal method to communicate, implement, oversee and track to completion ETC findings and recommendations

Chevron reliability programs not effective to implement ETC Sulfidation Failure Prevention Initiative

Important safety projects not brought to management rather than IMPACT team for approval if outside framing document requirements

Assumption that non-inspected components were of sufficient thickness

100% component inspection not in Richmond Inspection Plan

No guiding emergency leak response protocol in place

Requests for replacement or 100% inspection outside of framing document requirements

Turnaround team relied on inspection data

Low-silicon component not inspected

Unit metallurgists were not consulted

Consequences of potential damage mechanisms were not evaluated

Chevron did not use API 574 default values
Chevron allowed inspector to lower alert thickness
No MOC performed to evaluate risk of new T-Min

Recommendations to replace or 100% inspect 4-Sidecut line not implemented

Inspection data did not indicate pipe was thin

Risk of catastrophic failure not perceived by decision makers

Stop Work uncommon for shutting down plant

Trust in management

"Stop Work" not called

T-Min lowered so 4-sidecut could stay in operation

Past practice is to keep running with a small leak

Decision to remove insulation to identify leak location rather than shut down unit

Increased sulfidation corrosion rates in low-silicon carbon steel

Line constructed of variable corrosion rate-prone carbon steel

4-Sidecut piping component was extremely thin

Leak in 4-Sidecut line

"Hot Zone" not of sufficient size to protect personnel

Released process fluid autoignited

Flammable material released

Oxygen source

People present

Ignition source

19 potential worker fatalities, 6 injuries, 15,000 people sought medical treatment