

Incident Learning: Contained Deflagration

3 May 2018



Platformer Flow Diagram

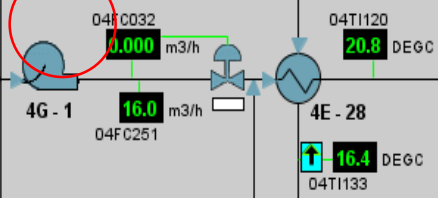
PLATFORMER : PLANT 4

REGEN MONITORING

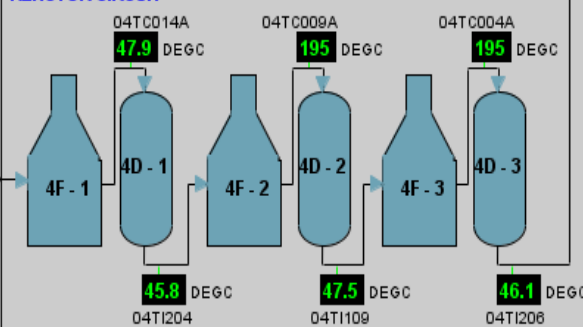
HSR FROM 71C - 17
VIA 3E - 4

DIH BOTTOMS
FROM 71C - 14

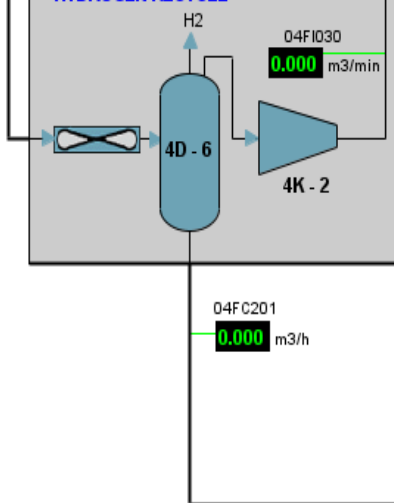
FEED



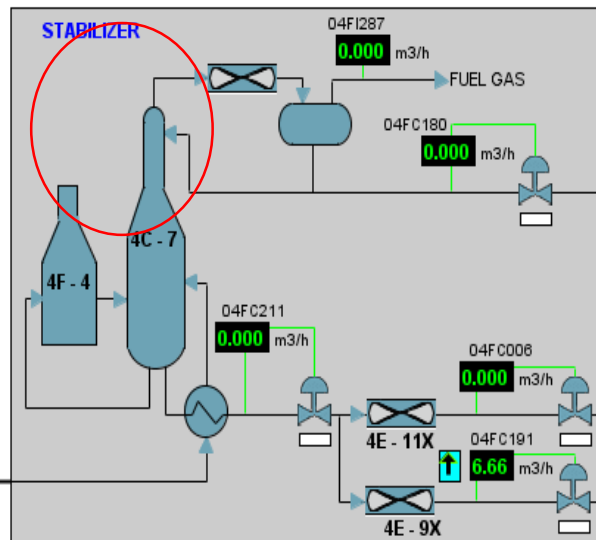
REACTOR CIRCUIT



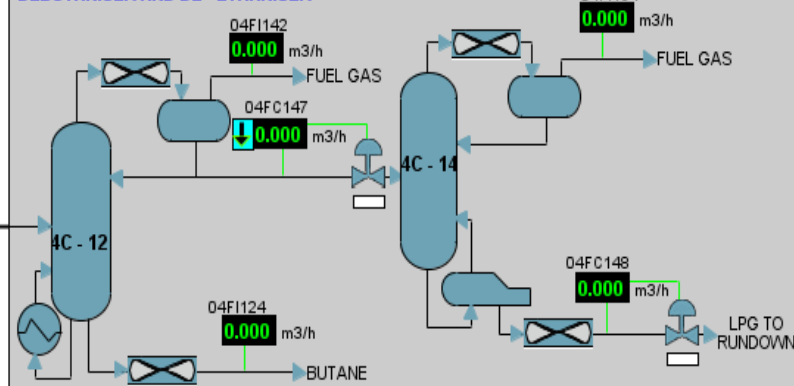
HYDROGEN RECYCLE



STABILIZER



DEBUTANISER AND DE - ETHANISER



MEDIUM
PLATFORMATE

HEAVY
PLATFORMATE

LAB RESULTS :

PLATFORMER RON	99.0	Number
STABILIZED PLATFORMATE RVP	53.6	kPa
HEAVY PLATFORMATE RVP	70.2	kPa
MEDIUM PLATFORMATE RVP	72.1	kPa

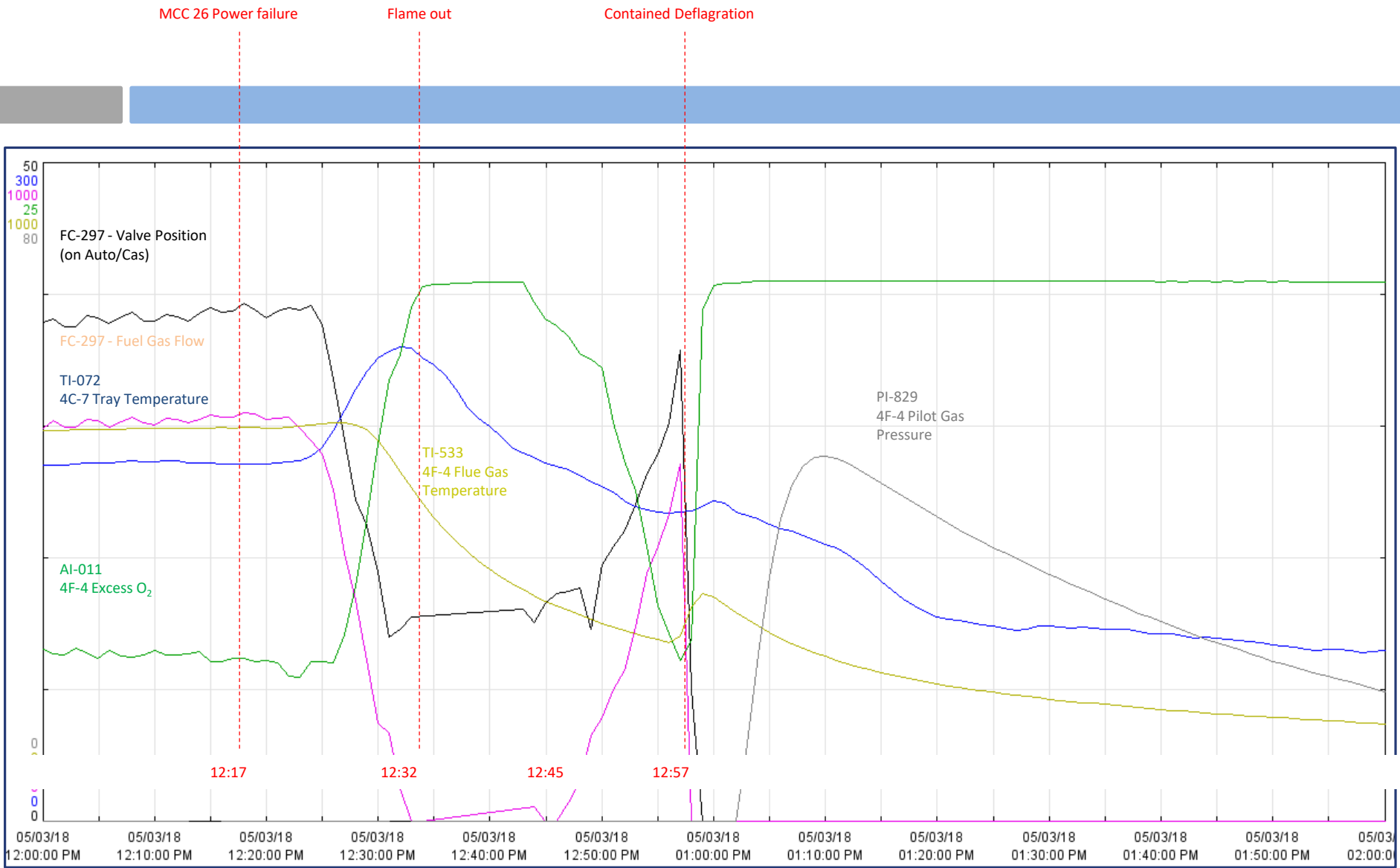
Incident Summary

At approximately 12:17 pm on 3rd May 2018, While troubleshooting an electrical fault on the cooling water pump (52GM-218A), the side of the substation where the motor circuit breaker was situated tripped impacting MCC 26. MCC 26 houses mainly switchgear for the Isomerization unit motors including 71G-12 which pumps into to the Platformer unit feed pumps 4G-1/1A. The motor-driven pump, 4G-1A, went down when 04ESD-104 registered a low suction pressure and tripped the pump.

While attempting to re-establish feed to the Platformer unit the stabilizer reboiler furnace 4F-4 fuel gas controller closed resulting in loss of main flames. The fuel gas controller was in AUT/CAS mode with the stabilizer column #25 tray temperature. After a while the fuel gas controller reopened and allowed uncombusted fuel gas back into 4F-4.

At 12:57 a deflagration occurred inside 4F-4 which resulted in damage to the furnace floor, burners, inlet air ducting as well as inlet air dampers. There were no reported injuries or fires and the unit was shut down safely.

Incident Trend



#	Causal Factor	Root Cause Explanation
1	The operator does not shut the Platformer unit down after 4G-1A tripped	One existing operating procedure addresses steps to be taken in the event of 4G-1/1A (feed) failure, procedure CDMS 1133 – Emergency Procedure for Long Term Feed Failure. If the procedure had been followed the DCS operator would have had to manually activate 04ESD-189 on 4F-4 and instruct outside operator to isolate fuel to individual burners – this could have prevented the contained deflagration in 4F-4. The investigation team noted that the procedure, as written, is ambiguous in its title as well as only covering mechanical failure of 4G-1/1A. The failure of 4G-1/1A due to activation of 04ESD-104 is not covered in the procedure. Instead of shutting down the Platformer when the Isom unit went down, the shift team repeatedly attempted to run up the turbine while requesting DCS to force enable 04ESD-104. On the day of the incident the DCS operator reminded the RSL of a previous occasion when they also forced 04ESD-104 to save the Platformer and suggested to force the ESD again. The request to force enable the ESD was made without following procedure CDMS 333 – Management of Safety Instrumented Systems, i.e. the SIS Override and Bypass form was not done nor was a PTW obtained. The Control Systems Analyst initially requested the RSL to provide the required paperwork but executed the request (to save the plant) after RSL promised to provide the paperwork later. The previous occasion referenced above was that of 11 Dec 2017 when MCC 26 tripped after an underground cable was hit during construction work. During this incident the fuel gas controller responded in almost exactly the same manner it did on 3 May with one exception, the fuel gas flow to the furnace did not fall away completely. The investigation team suspects that the controller may have stuck in an open position allowing fuel gas into the furnace hence the main flame was not lost. Process trend history from 04PI-829 indicates that there were no pilot gas supply to the furnace at the time. From subsequent plant recovery meetings it was apparent to many that Ops <i>forced</i>* 04ESD-104 to prevent the Platformer unit from shutting down. <i>*The investigation team later learnt that although the request was made, the ESD was not activated due to suction pressure not falling low enough to trip the pump – most likely due to Ops managing to start up the turbine driven pump 4G-1. The team also agreed that it is immaterial that the ESD was not actually forced on the 11'th, the intent was to force 04ESD-104 to save the Platformer unit and therefore to not follow procedure.</i> Upon further investigation into the human performance dynamics that contributed to the decision taken on the day, the team noted a few concerning issues that needs to be highlighted. These are • The function and importance of ESDs are not well understood by all who operate them. It would appear as if these are seen as hindrances (to keeping units on line or getting them started up asap) instead of as important safety devices that prevent or mitigate impact to personnel, the environment and equipment. • Written procedures are not consistently followed and is not easily accessible. • Some operators feel they are not empowered to shut down a plant (especially the Platformer) for fear of reprisal if SWA is used. DCS operators would refer decision to shut down units to the RSL on duty during back shifts and/or wait for LT to advise during dayshifts.

#	Causal Factor	Root Cause Explanation
2	There is no low/high fuel gas pressure trip for this furnace as required by MFG 210	MFG 210 Manufacturing Instruction for Fired Equipment Operation, specifies minimum standards for fired equipment in Chevron wholly owned refineries and was rolled out in the MFG organization in Jul 2015. The instruction requires, amongst other, a low and high fuel gas pressure shutdown for fired heaters. In consultation with Fired Heater BIN it was agreed that implementation for fired heaters was at the discretion of RLT. Engineering works requests EWR 2768 and 2769 to implement FG pressure trips on fired heaters on south- and north-side of the refinery were registered in Jan 2016. However, up until before the incident the project was still in Phase 1. The implementation of MFG 210 did not receive the right level of commitment to roll out and implement timeously. The investigation team cited the following contributing issues: • MFG 210 project given to untested PM as a development opportunity; • Detailed engineering work did not progress which led to missed opportunity for early implementation, hence deferred to the 2022 and 2025 TA cycles; • No interim mitigation were implemented – if a combustibles analyzer was installed it would have mitigated the incident.
3	The pilot gas system is plugged	As per the Fired Heater BIN, minimum fire bypasses (MFBP) are preferred over pilots to prevent a firebox explosion caused by the fuel control valve closing and re-opening unexpectedly. Pilots should not be relied upon as safety devices without flame detection (flame rods or flame scanners). They are a lighting convenience, but cannot be relied upon to re-light the burner under all operating conditions (per API 535). However, in the Cape Town Refinery context, our fired heaters are not equipped with MFBPs and the general understanding was (and still is) that commissioned pilots was considered as a safeguard against main flame failure in the event of the fuel gas controller closing and reopening. It is in this context the following observations are made • 04PI-829 consistently read pressure readings of -0.17 to 0.25 kPa on DCS after the Platformer regen in March 2018 • No works requests were registered for 04PI-829 • Multiple DCS operators missed the opportunity to submit a works request on multiple occasions to have the instrument checked out (04PI-829 only registered healthy readings on three separate occasion in over 200 days); • After the incident the pilot gas ring main was found to be holed and pilot gas strainers plugged, i.e. little to no pilot gas were going into 4F-4; • Steam tracing to pilot gas header found to be isolated since 2015; • sRCM studies conducted did not identify need for PM strategy; • Corrective actions to the 4F-2 and 56F-201 incidents did not carry over to 4F-4 and other fired heaters.

#	Recommendations
1.1	Revise CDMS 1133 to include all possible Platformer unit feed loss scenarios, specifically an MCC 26 power failure which impacts 4G-1/1A. The procedure should be clear on immediate interim steps to be taken when 04ESD-104 is activated and trips 4G-1/1A. Interim steps must include taking control of 4F-1/2/3x/4 heater fuel firing such as, but not limited to, putting FG controllers on manual and reduce gas firing to posture unit until decision taken to restart or to shut down.
1.2	Review company policy with respect to bypassing or force enabling ESD systems that have been activated and are functioning as per design. Revise CDMS 333 accordingly such that the procedure should only be followed for malfunctioning instruments, fault finding and functionality testing and not to be used to bypass safety systems to keep plants on line. Revise CDMS 333 to include PSM consultation and signoff as well as HES manager signoff (to enforce independent review of ESD bypass requests). Communicate this change to all Ops personnel.
1.3	Reaffirm company policy to always follow written procedures. Develop internal audit plan to evaluate adherence to procedures. Communicate consequences of not following written procedures to workforce. Ensure consistent enforcement of policy (with positive and negative consequences). Communicate examples of positive recognition of employees following procedure.
1.4	Redesign CDMS management interface to allow for quick access to operating procedures. Consider implementing model used at Richmond refinery.
2.1	Review MFG 210 compliance project with aim to re-prioritize and fast-track the project for implementation in 2020/22 TAs or earlier. The review should include - Implementing interim mitigation on all fired heaters on site; - Assign a skilled PM with proven project management skills; - Ensure it receives regular oversight at management level.
2.3	Include MFG 210 requirements for all existing plant and capital project PHA studies that involves fired heaters, boilers SRU fired equipment, incinerators and FCC direct fired airline heaters.
3.1	Install minimum fire bypasses on all fired heaters on site regardless of whether fired heaters has pilots or not, and then, In consultation with the Fired Heater SME, the RLT must decide to continue or discontinue maintaining existing pilot gas systems on fired heaters.