

## **E-310B failure leading to H<sub>2</sub>S slippage in HDS section on 9.1.2017**

### **Incident**

On 9th Jan 2017 at 09:00 hrs lead acetate test was performed in HDS section. R-301 hydrogenator outlet lead acetate test was positive and Lead acetate test was performed at the outlet of desulphurization section (R-302A) which also came positive.

### **Background**

NHGU plant was running with H<sub>2</sub> production of 90 T/D. NHGU feed was HCLN (9500 Kg/hr), CCR off-gas (21 T/D). Plant was running normal.

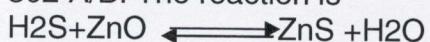
### **Actions Taken**

Trouble-shooting of the probabilities of sulphur break-through ex desulphurization section was done

1. Operating temperature increased
2. H<sub>2</sub>/HC ratio increased
3. Feed Sample drawn to check sulphur content
4. Samples drawn across Desulphurization section to check sulphur and chlorine content

### **Analysis**

Normally in R-302 A/B H<sub>2</sub>S is picked up by the zinc oxide catalyst present in R-302 A/B. The reaction is

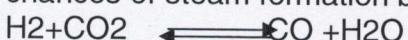


This reaction is reversible and the reversible reaction is highly dependent on the steam content present at the inlet of R-302A/B

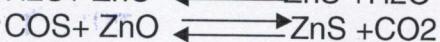
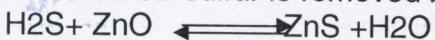
There are two probabilities for presence of steam in feed

#### **1. If feed contain CO<sub>2</sub>:**

If feed stock contain CO<sub>2</sub> and high concentration of hydrogen then there is chances of steam formation by the below reaction



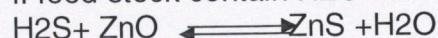
In R-302A/B sulfur is removed by following reaction



So the presence of CO<sub>2</sub> in feedstock may strip off sulphur present in desulfurization catalyst. So with this condition lead acetate test will be positive.

2. **If feed contain H<sub>2</sub>O:**

If feed-stock contain H<sub>2</sub>O then the reverse reaction will occur in R-302 A/B



So the presence of H<sub>2</sub>O in feedstock may strip off sulphur present in desulfurization catalyst. So with this condition lead acetate test will be positive.

Analysis of above two possibilities done:

- i. CCR off-gas sample was checked for CO<sub>2</sub> content. All samples showed nil CO<sub>2</sub> content in CCR off-gas. So possibility of sulphur due to CO<sub>2</sub> present in feedstock was over-ruled.
- ii. Second possibility was analyzed. Source for steam in feedstock was checked if feed preheat exchanger leaks. Checked sample at R-301 O/L bed content was observed. E-310B (Feed Pre-heater) was isolated and sample checked after intervals and sample at R-301 O/L was seen moisture free. Lead acetate test was carried at R-302 A mid and O/L bed which showed negative (No sulphur presence)

**Conclusion:** The H<sub>2</sub>S slippage in HDS section was due to Feed Pre-heater.

**Learning and Recommendation :**

- Always conduct Lead acetate test at R-302 A outlet in shifts to check slippage in HDS section.

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## **Minor Fire In CDU-3 ISBL Tech Structure Near Road**

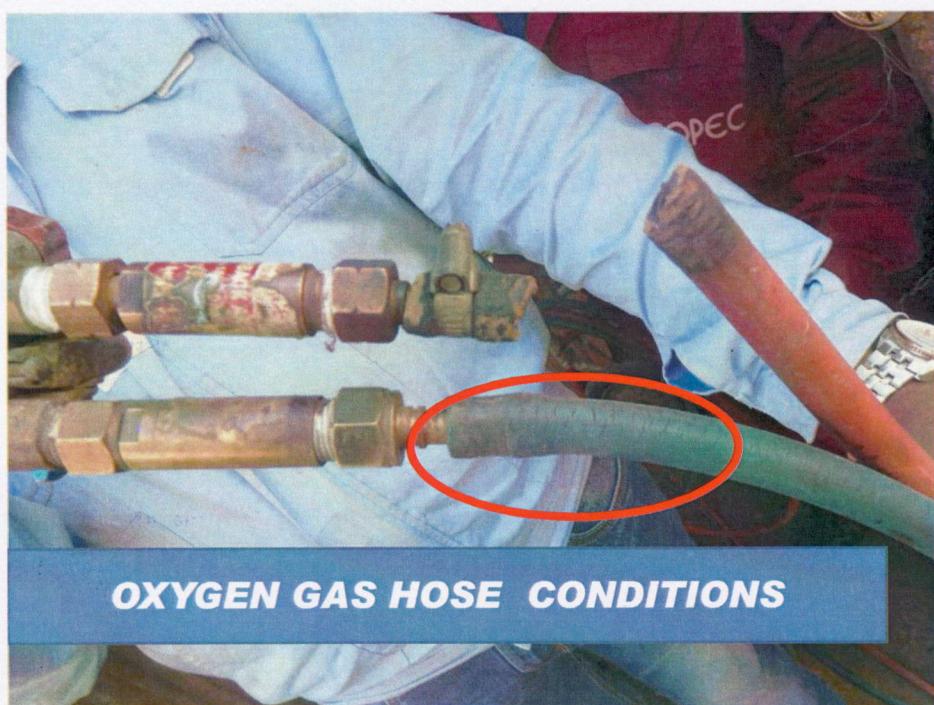
### **No 3 on 17.2.2017**

#### **Introduction**

On 17<sup>th</sup> February 2017, at 1645 hrs there was a minor fire on welding equipment at first floor of TS-1 in CDU-3 complex.

#### **Background**

- Gas cutting work was in progress for 12" Hot feed line for DHT on 1<sup>st</sup> floor of Tech structure 1 of CDU-3 complex. Gas cutting was being done at height inside the booth protected with fire retardant cloth.
- Gas cutting set has LPG hose clamped using jubli clamp. While doing gas cutting, gas leak developed from the LPG hose connection. Sparks generated through gas cutting initiated fire at leaky clamp location.



## Investigations

### a. Site Inspection/Observations :

- Scaffolding for work at height was observed having no proper ladder approach.
- LPG hose was found crack and burnt near the clamp location.

## Analysis

- Gas cutting set had leaked because of loose clamp and cracked hose. Also hose leak test was not carried out before start of work at fresh location.
- LPG vapors would have accumulated at hose leaky location and as soon as spark for gas cutting was generated, LPG vapors caused fire.
- Escape route was not available for scaffolding platform.

## Conclusion:

- It is concluded based on the analysis that loose clamp of LPG hose of gas cutting set and non performance of leak test has resulted in fire.
- Proper escape route ladder was not ensured throughout the work.

## Recommendations:

- All the cracked gas hoses shall be cut and removed for avoiding re-use in future.
- Leak test of all the gas cutting set shall be ensured before start of every job.
- Proper escape route to be ensure throughout the work.

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## 131-P-102 Tripped On Faulty PLC Signal on 25.5.2017

### Incident:

On 25<sup>th</sup> May, 2017 at 13:36 hrs, Preflashed Crude Pump 131-P-102 tripped on faulty PLC close signal of pump suction MOV-1106.

### Background:

NCDU/VDU plant was running at a feed rate of 20500 T/D processing Upper Zakum- 52%, Arab Extra Light- 15%, Basrah Light- 6%, Seria Light Extra Blend- 6%, Murban- 2% and Slop- 19% with all the products on grade.

NCDU/VDU receives crude from P/H-1. Received crude is first desalted and then sent to pre-flash drum (V-101). Lighter fractions from crude get flashed in pre-flash drum and are sent straight to distillation column. The heavier fractions are pumped with 131-P-102 A/B/C to the distillation column via 131-F-101 which heats the crude to a desired temperature.

P-102 can trip on two interlocks:

1. When pre-flash drum level reduces to 18.5%, P-102 suction MOV closes and the pump trips.
2. When P-102 suction MOV closes.

At 13:36 hrs, faulty MOV closed signal was sent to PLC and hence the pumps got tripped. Suction MOV of P-102 was checked in field and it was found in open condition. MOV was then immediately kept forced open from PLC and 131-P-102 was put back on load at 13:41 hrs.

Parameter	Tag	Normal	During emergency
Crude Flow, T/D	rmpcorrlw.pv	20500	3369 (min)
Pre-flash drum Level	rmprlc111.pv	72	95.5 (max)
P-102 discharge Pressure (kg/cm <sup>2</sup> )	rmprpi219.pv	33	11.9 (min)
F-101 HOT, deg C	rmprtc165.pv	359	401 (max)
F-102 HOT, deg C	rmprtc276.pv	392	404 (max)

Furnace-101	Normal		During emergency	
	Flow	Radiation O/L temp	Flow (min)	Radiation O/L temp (max)
Pass 1	2760	371	1480	405
Pass 2	2745	366	1315	405
Pass 3	2515	363	1265	402
Pass 4	2250	360	1300	390
Pass 5	2400	355	1345	390
Pass 6	2260	362	1435	399
Pass 7	2275	368	1375	405
Pass 8	2350	364	1160	405

#### Corrective actions taken:

1. All the downstream units and P/H 1 was informed about the emergency.
2. Crude flow through F-101 decreased and the furnace outlet temperature increased from 359 to 401 deg C. To reduce furnace outlet temperature, firing in the furnace was reduced. F-101 trips when flow through any pass reduces to 900 T/D and radiation outlet temperature of that particular pass increases to 394 deg C. As the flow through all the passes remained above 900 T/D, the furnace did not trip.
3. C-101 bottom level decreased to 25% and hence RCO flow through F-102 decreased. F-102 outlet temperature increased from 392 to 404 deg C. To control furnace outlet temperature, furnace firing was reduced.
4. C-110 bottom level decreased to 22%. VR to BBU was reduced from 2300 T/D to 500 T/D.
5. Product flow ex CDU and VDU was reduced to maintain the stripper and tray levels.
6. P-102 was put back on load on 13:41 hr, crude to unit was increased slowly. Furnace firing was also increased simultaneously and plant normalized.

#### Observations:

Total analysis was done of all the alarms before and after the incident. It was observed that only MOV close signal alarm was generated at the time of incident and no other abnormality was observed. This alarm got generated due to problem in MOV internal card. It was decided to keep the MOV force open from PLC till the card is replaced.

#### Conclusion:

The faulty close signal of MOV led to tripping of the pumps.

#### Learnings:

Healthiness of MOV cards to be ensured by periodic checking.

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## **LVGO CR Control Valve Bypass Gland Leak on 29.5.2017**

### **Incident:**

While taking LVGO control valve (RFC 206) on bypass on 29<sup>th</sup> May, 2017 at 10:37 hrs; gland leak occurred from the bypass valve leading to plant disturbance.

### **Background:**

NCDU/VDU plant was running at a feed rate of 21000 T/D processing Upper Zakum- 60%, Basrah Light- 30% and Slop- 10% with all the products on grade.

LVGO CR control valve (RFC 206) was stuck up and was operating only in the range of 50 to 70%. Therefore it was decided to take control valve on bypass to handover to instruments.

LVGO CR flow was 10200 T/D and opening was 70% when bypass activity was started. Maintaining LVGO CR flow at 10,000 T/D, RFC206 bypass was slowly opened in the field while at the same time control valve was closed from 70 to 50%. At 10:37 hrs, bypass valve and its associated piping started vibrating and its gland started leaking.

### **Corrective actions taken:**

- Feed to unit was dropped to 14000 T/D. P/H-1 and other downstream units were informed about the feed reduction.
- Firing in both the furnaces was adjusted.
- Fire station was kept standby.
- LVGO pump was stopped to attend the leak. Gear box of bypass globe valve was sent to machine shop. Its gear box check nut and ring was found in broken condition.
- HVGO pump 131-P-134B was on load and its amp was 53 (Red amps 58). HVGO total flow was increased while monitoring the amps of the pump. At 11:58 hr. HVGO pump 131-P-134B tripped on red amps. At 12:04 hr. 131-P-134A was put on load.
- VDU bed temperatures, level and pressure was closely monitored.
- At 12:15 hr. ATF was called off. HK was diverted to SKO and LK was diverted to DHDS.
- At 13:15 hr. VR to BBU was called off and same was diverted to FOB IV.
- RFC 206 bypass valve's gear box was fitted back and gland was repacked by maintenance.
- At 14:10 hr. 131-P-133A was put back on load and RFC 206 was taken in line.
- Plant was normalized and products were diverted on grade.

### Observations:

When control valve was being taken on bypass mode, the associated lines started vibrating when control MV was closed from 70% to less than 50%. This control has a high pressure drop across it (Pressure drop for Min/Normal/Max flow are 19.1 Kg/cm<sup>2</sup>/9.8 Kg/cm<sup>2</sup>/7.9 Kg/cm<sup>2</sup> respectively). As bypass valve was not able to cater for such high pressure drop, line started vibrating and subsequently it led gland leak of bypass valve.

### Conclusion:

Bypass valve gland leak was mainly due to high pressure drop of the control valve which led to high vibration in the piping.

### Learnings:

Control valve which have high pressure drop should be provided with bypass valve of same characteristics.

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