

Near Miss Event Incident Report

Gas detection alarmed on high Carbon Monoxide (CO) inside a High Pressure Distillation Column (T-1502)

4TH APRIL 2015

T-1502 HP Distillation Column



Inlet –Outlet of T-1502

- T-1501 bottom liquid which removed lighter impurities in T-1501 is fed to T-1502.
- Liquid contains about 75 wt.% of methanol, about 25 wt.% of water and small quantities of heavier impurities such as Ethanol, higher alcohol and heavier paraffin.
- T-1502 is operated at 0.735MPaG of column top pressure, which is controlled by liquid level of E-1507A/B (HP/LP Column Exchanger) shell side.
- Purified methanol vapor from the top of T-1502 is condensed in E-1507A/B and collected in V-1503 (HP Column Reflux Drum).

Event Description 1

Incident Location: T-1502 (HP distillation Column)

Incident Time: 1250

Incident Date: 4 April 2015

Immediate action (s) taken:

- The work site supervisor (WSS) stopped all activities and instructed his staff to evacuate and standby, while he reported to BMC CCR PIP room, the permit to work was immediately suspend.

Event Type: Near Miss

Risk Ranking: 4B (People)

Potential Loss: Human Fatality

Event Description 2

- On the 4th of April 2015, a four head gas detection monitor alarmed on high carbon monoxide (CO) at two different location inside a High Pressure Distillation Column (T-1502) just as personnel were preparing to enter into the vessel for scheduled internal inspection.
- The first carbon monoxide (CO) alarm triggered at the bottom of T-1502 manhole at about 1250 hours.
- The second carbon monoxide (CO) alarm triggered at the 65th tray (middle) manhole at about 1300 hours.
- The CO reading at both locations was in the range of 7-70ppm.
- Prior to the event of 4th April 2015, a similar near miss incident occurred on the 2nd of April 2015 inside the same HP distillation tower.

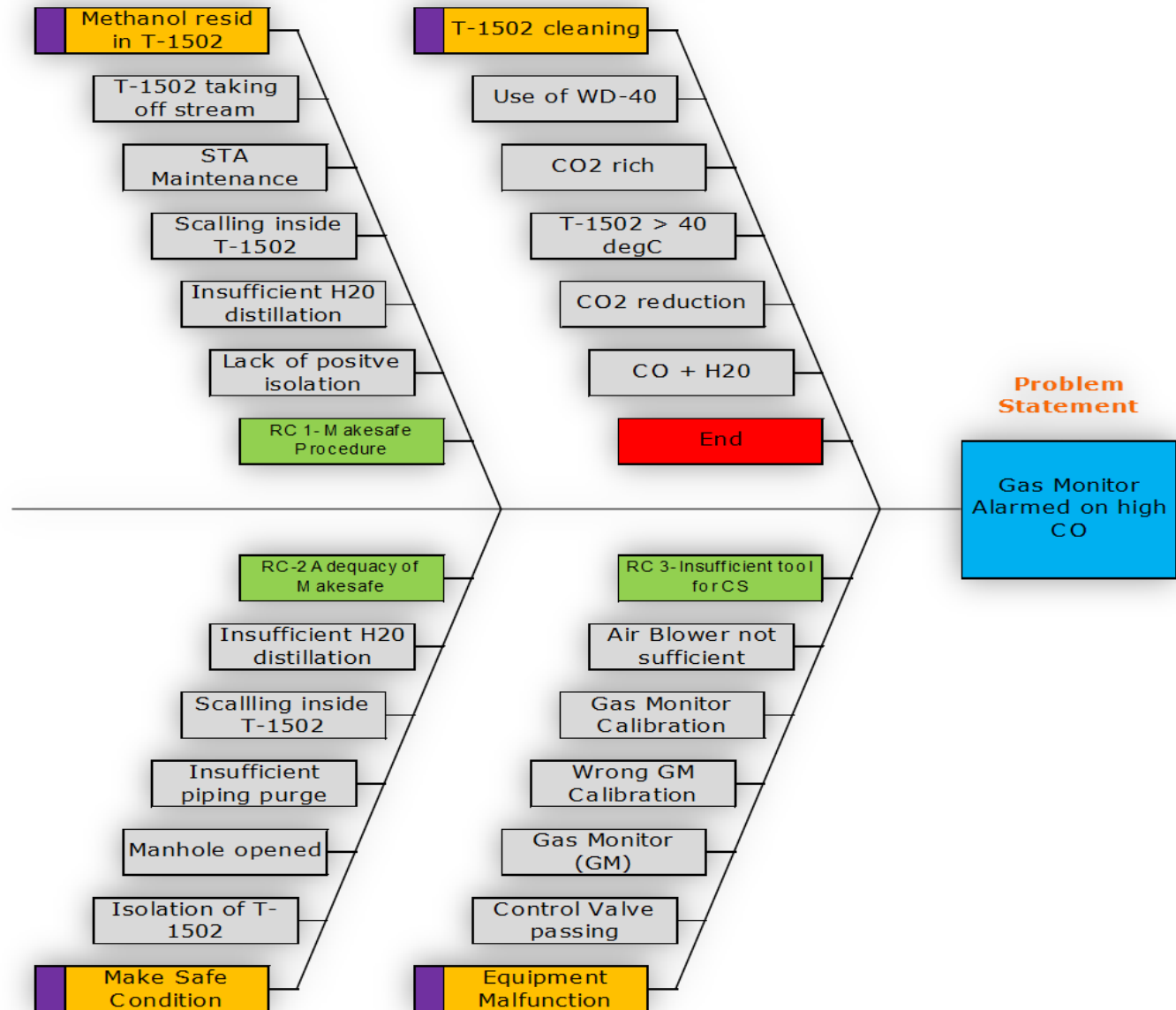
Findings 1

1. T-1502 was totally in a make safe condition prior to handing over to maintenance section.
2. Water (H₂O) distillation was used as part of the make safe condition.
3. T-1502 manhole was opened on 29th March 2015 for ventilation.
4. Three manhole was opened in T-1502 (top, middle & bottom section).
5. Two blowers were used at bottom and middle to ventilate during the day time only.
6. No CO was detected in the morning of 2nd April but detected in the afternoon and no one was permitted to enter T-1502.
7. The investigation team found no evidence of a follow-up action on the near miss incident of 2nd April 2015 after contractor worksite supervisor submitted his notification.
8. More than one gas detectors were used on 2nd April to verify the CO concentration inside T-1502.

Findings 2

7. The concentration of CO gradually increased up to 70ppm.
8. No CO was detected on 3rd April and all activity resumed inside T-1502.
9. Internal inspection was carried out at the middle manhole with three contractor personnel carrying out the activities, while one stood by as stand by man.
10. No CO was detected in the morning of 4th April but detected in the afternoon and no one was permitted entry into T-1502 after the gas detector alarmed on high CO.
11. The gas detector was used for continues monitoring prior to entry at all times.
12. During the investigation, CO was only detected when the column is ventilated, five different gas detection devices were used and all five gas monitoring devices detected CO (5-15ppm)
13. There was no evidence that suggest anyone was inside the HP distillation tower (T-1502) when the gas detection device alarmed on high CO on both instances.

Event Cause Analysis



Cause Analysis 1

➤ Immediate Causes

- Residual methanol was still being detected inside T-1502 and it was detected as CO by four head gas detection monitors when the column was ventilated with blower.

➤ Contributing Causes

- The four head gas detection monitors were alarming on high CO while detecting methanol.
- Lack of follow up on the near miss of 2nd April 2015

Cause Analysis 2

➤ Underlying Causes

■ Water distillation

- ✓ Residual methanol was still detected inside T-1502 suggesting that the water (H₂O) distillation as part of the make safe condition of the vessel was inadequate.

■ Inadequate positive isolation for T-1502

- ✓ The isolation was made for the entire distillation section instead of providing positive isolation specific to HP Column unit as part of the make safe condition(refer to appendix for the marked up drawing) .

Cause Analysis 3

- Inadequate ventilation of the column
- ✓ There was no evidence to suggest T-1502 was continuously air purged after the make safe condition, although two air blowers (refer to figure 1&2) were used for the push and pull of air at the bottom and middle manhole.
- ✓ Air circulation was not continuous.
- ✓ Air blower was only used intermittently and the equipment was considered inadequate for that kind of service.

Ventilation at T- 1502 (with blowers)



Figure 1: Blower Used at the Bottom of T-1502

Ventilation at T- 1502 (with blowers)

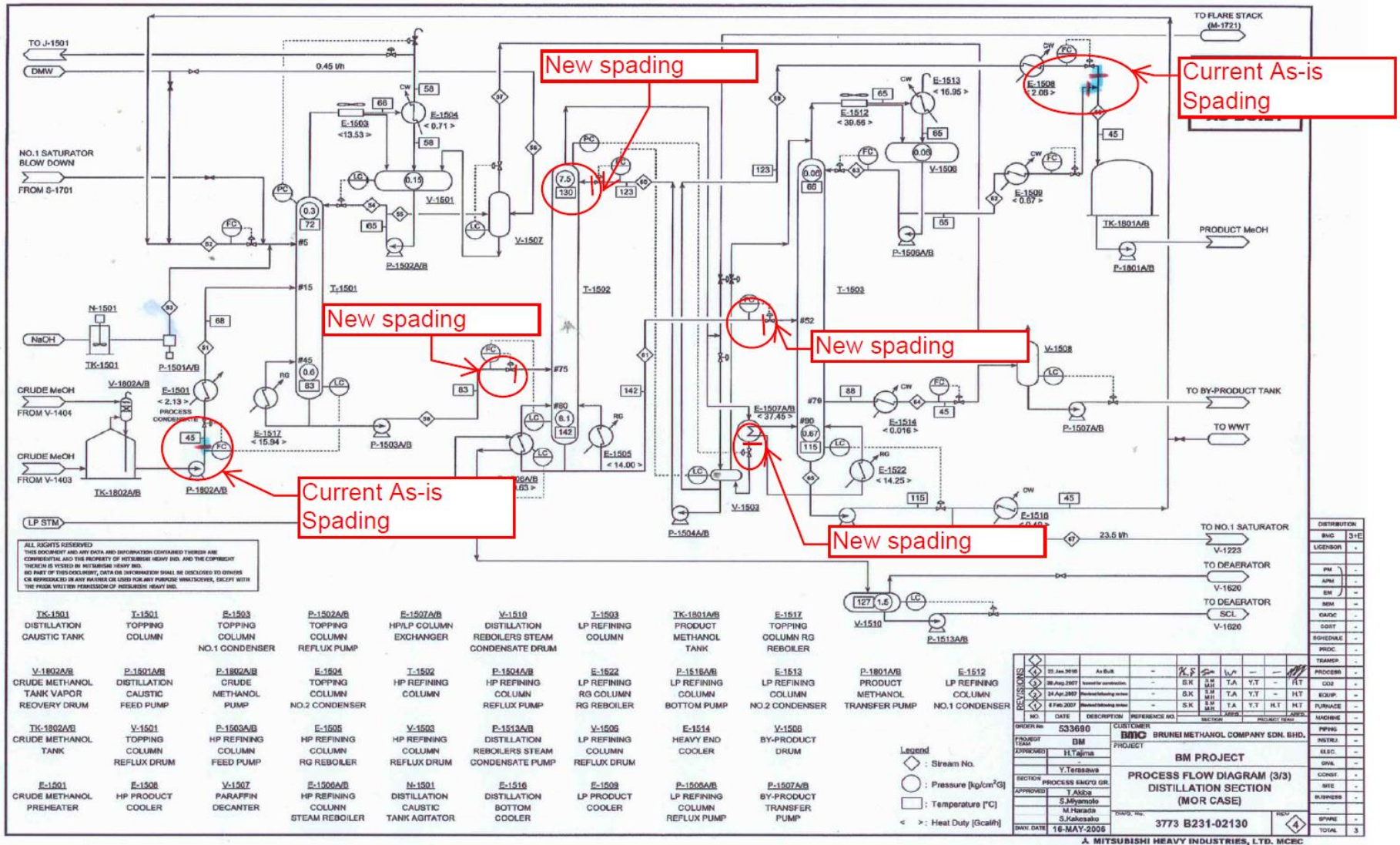


Figure 2: Blower Used at the 65th tray manhole of T-1502

Recommendation

1. Update the make safe condition procedure to emphasize positive isolation for HP distillation Column instead of entire distillation section. (refer to Appendix 1)
2. Update the make safe condition procedure to include a minimum of 72 hours continuous push and pull air purge of T-1502 before entry.
3. Upgrade the four head gas monitoring device.
4. Include in the make safe procedure;
The use of Tiger VOC detector, as part of the make safe assurance from methanol residue.
5. Update the Incident Investigation Procedure to provide clear guideline for all near miss reporting and follow up.
6. Train the operations team on the updated near miss reporting protocol.

Isolation Points of Distillation Section as Part of Make Safe and New Spading Points



A1	3773	B240-50022
----	------	------------



Learning from Incident (LFI)


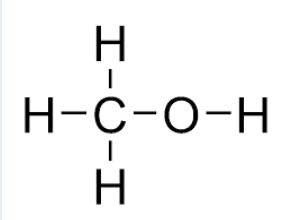
- Near miss reporting - There is a need for improved communication between all stakeholders, if the near miss incident of 2nd of April 2015 was reported and investigated, this would have mitigated the near miss of the 4th April 2015.
- Methanol monitoring should be used as part of the make safe condition after Water (H₂O) distillation.

Permissible Exposure Limit (PEL) (WSHO, 2009)

	TWA	STEL
Carbon Monoxide	25ppm	125ppm (25X5)
Methanol	200ppm	250ppm

- TWA: Permissible exposure level over an 8-hour working day and a 40-hour work week
- STEL: permissible exposure level over a 15-minute period during any working day

Permissible Exposure Limit (PEL) (WSHO, 2009)

		TWA	STEL
Carbon Monoxide		25ppm	125ppm (25X5)
Methanol		200ppm	250ppm

- TWA: Permissible exposure level over an 8-hour working day and a 40-hour work week
- STEL: permissible exposure level over a 15-minute period during any working day

The End
Thank You