ZENITH

185 metre Dismountable Flare Project Overview - 2009

Introduction

This paper is intended to provide an overview of the dismountable flare project completed by Zenith SAS Ltd at a petrochemical facility in 2009.

Background

The structure comprises of a 185 metre, high supporting tower with four independent flare risers (three active and one spare) sections, all of which are dismountable by the use of a crane ratchet type system. (Picture 1).

The original construction started in 2004 and the flare stack and supporting structure was commissioned in 2007.


PICTURE 1

Periodic maintenance is anticipated with the risers sections designed to be lowered to ground level for overhaul. A defect was noted at the top of the structure in early 2009. By mid 2009 a very obvious displaced pipe was noted on the flare tip. In addition the tip itself was clearly in poor condition and in the process of early disintegration. Following careful consideration, it was estimated that the defect was not likely to exceed 50 Kg in weight and it could fall to ground without prior notice. The predicted location of the falling pipe work was at ground level in front of the structure but directly in the 'working zone' required for servicing the flare stacks. In order to complete any activities in this area corrective action or temporary overhead protection was deemed essential. (Picture 2)


PICTURE 2

Philosophy

Zenith was introduced at an early stage of the project because of their flare stack and working at height experience. Zenith examined a number of potential options

- Take no action
- Ascend to height and remove the defect
- Install a temporary overhead protection
- Install a permanent overhead protection

Option 1 and 2 was eliminated at an early stage as they presented a sizeable hazard which could not be mitigated to an acceptable level.

Option 3 & 4 appeared to be the most practical option. Within these options were two further subcategories which included 1) A supported section or 2) A freestanding section.

The supported section placed excessive loading on the existing structure and was discounted.

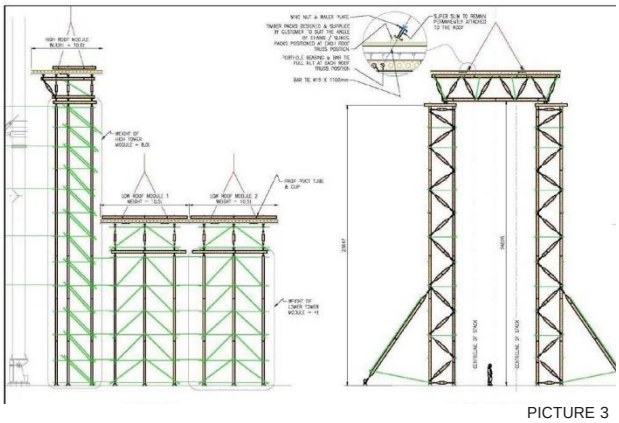
A main freestanding overhead protection was deemed to provide the preferred option in conjunction with an integrated section within the structure.

A temporary solution was preferred to a permanent one.

Overhead Protection

An integrated crash deck protection was firstly erected within the derrick structure at an elevation 33.00 metres at the top of the accessible region. This protection made allowance for a small canopy cantilevered over the 'working zone' to provide close in protection and consequently allowed the main overhead protection to be constructed.

The main freestanding overhead protection was constructed in two phases. Firstly piecemeal off site and finally in-situ with overhead protection constructed in a manner to increase the radius of protection systematically. These sections were craned into position with the cranes placed out with the perceived danger zone. (Picture 3).



PICTURE 3

The original design of the overhead protection was considered, on the basis of a 50 kg weight falling 185 metres, achieving a final velocity of 60.2 metres/second with an impact of around 200 KN assuming a distance travelled after impact of around 300 mm. The roof therefore was designed on an ultimate load basis with as large a design deflection as possible. The theory being that the larger the deflection the lower the impact load. The overhead protection was originally designed as a portal frame profile with a hipped roof. However, the design became complex and labour intensive, and the sections were considered too heavy to lift into place. Following a progressive design review the scheme was detailed with a flat retractable roof to provide a safe area to carry out the works.

Dismountable Scheme

Firstly the spare flare required to be mounted into the final working position (The spare temporary flare adjacent the stack in question was in a lowered position) and it was raised to the necessary height and commissioned. Once this was achieved the lifting and rigging equipment was moved to the dismountable riser and positioned and tested. The riser comprises of ten number, 10 tonne sections with the heaviest lift being the initial lift of 100 tonnes. (Picture 4)

PICTURE 4

The lifting arrangement comprises of a combination of pulley sheaves with a 10 reeve system over a 100 tonne block system. A 30 tonne pulley system was also in place for the lowering and raising of the riser. A pair of skid mounted hydraulic winches are permanently in position at ground level. This winch arrangement had its own separate protection canopy for the winch operator.

The sections of riser were then lowered from their initial vertical position. The lower section was then disconnected from the main riser and lowered onto the canting table and bolted to the table. The lower riser section, using the winching arrangement was then 'canted' from the vertical through approximately 85 degrees until it rested a temporary saddle. The riser section was very carefully rotated through 90 degrees prior to its 'at rest' position to prevent damage to steam lines which projected some distance from the face of the riser. Once the section was at rest the demountable roof was replaced and the lifting equipment and tackle could then be removed. With the overhead protection in place the operatives were able to carry out the final disconnection in safety. (Picture 5)

PICTURE 5

The lower section was then transported to a remote work area to begin a full repair and refurbishment exercise.

The canting technique was then repeated systematically until all sections were at ground level and removed for refurbishment.

One of the obvious drawbacks of this type of modification scheme is that the last section down is the first section to be erected thus the timeline of remove the old flare tip, refurbish the riser and connect the new flare tip is critical to reduce the off-stream period to a minimum. In this scheme the service time was used to remove the temporary protection scheme thus maximizing productivity on the project. (Picture 6)

PICTURE 6

The erection of the refurbished riser sections was competed in a direct opposite sequence with the highest section transported into position and canted into a vertical alignment raised directly up the winching path and the consequent section is then canted into position and the process is repeated until the riser is in its final position.

The riser can then be commissioned with the spare flare riser lowered into standby position or brought to ground for servicing in preparation for the next overhaul.

The flare tip project was completed within a 10 day, 24 hour working, critical off-stream period with an excess of 2000 man hours expended during the entire operation. (Picture 7)

PICTURE 7

Acknowledgements

David Kelly – Contract Director and all Zenith Field Team