Fatigue Risk Management in a Major Turnaround

Krystal Sexton, Shell, krystal.sexton@shell.com
Teri Lillington, Shell, teri.lillington@shell.com
Israr Ahmed, Shell, israr.ahmed@shell.com
Michael Bergeron, Shell, michael.s.bergeron@shell.com

Problem: Turnarounds (TA) can be extremely demanding for the people involved as they are typically performed in extended working schedules and in some cases with significant overtime. This can result in sleep deficits and fatigue, performance reduction and increased numbers of accidents. The first TA for Pearl GTL in Qatar, the largest in the history of Shell, involved over 7,000 additional staff with nearly 3,000,000 exposure hours. Because of the long shifts and the need to influence behaviour of workers to recognise the importance of sufficient sleep, a comprehensive set of fatigue management measures was implemented.

Methods: Prior to the start of the TA, a Fatigue Risk Management Plan (FRMP) was developed by Pearl GTL with support from Shell Health. It included managing working hours and consecutive days worked, such as one day off every 6 days (1:6) against the usual practice of working 1:13 in other Shell Turnaround projects and implementation of a self-reporting mechanism for fatigued workers.

To reduce commute time and provide opportunity for sound sleep, all TA personnel stayed in a camp facility provided by Pearl GTL located fifteen minutes from site. Additionally, a database using swipe card information at the worker entry/exit point was developed and monitored on a daily basis to identify individuals, teams, and craft groups working beyond their stipulated work hours. To identify fatigue-related incidents, TA incident report form included a question, 'How many hours the involved person(s) was/were able to sleep during the last 48 hours?'

To assess the effectiveness of the FRMP, compliance with FRMP requirements was calculated for Hours Worked, Days Off, Shifts over 16 Hours, and Consecutive 16-Hour Shifts. The association between fatigue and safety incidents was assessed using both incidents flagged as fatigue-related and proxies for fatigue using well-established lows in circadian rhythm as the definition (22:00-06:00 and 14:00-16:00). Finally, lessons learned were established for inclusion in future TAs.

Results: FRMP compliance was high overall. Over 95% of the workers were within the weekly maximum hours allowed, and 91% met the requirement of one day off every seven days. Of the 220 incidents including near-misses during the TA, only one was deemed to be related to fatigue. When using hour of incident as a proxy for fatigue (22:00-06:00 and 14:00-16:00), there was no difference in incident occurrence, type of incident, or severity of incident.

Lessons learned included the importance of educating workers on indicators of fatigue and risks of fatigue and maximizing sleep opportunity by providing nearby accommodations. Weekly review of the data identified jobs, crafts, and other areas

where non-compliance was occurring, allowing for immediate corrective action. More focus was needed on job types such as crane operators and professional drivers with potentially higher risk of fatigue. These lessons will be implemented for the next TA.

Discussion: This was the first TA at Pearl GTL and the largest one in the history of Shell. Despite the millions of exposure hours, thousands of workers involved, and high risk of fatigue, only one fatigue-related safety incident was reported. In addition, there was no difference in incident occurrence, type of incident, and severity of incident when hour of incident was used as a proxy for fatigue. This is interesting as often the impact of fatigue is evident in either more severe incidents or more frequent incidents at times when fatigue levels are high (such as night-time and mid-afternoon circadian lows), but Pearl GTL data did not show this normal fatigue-related pattern.

There are several reasons the risk of fatigue was controlled. Leaders were invested in a program called “Show You Care,” in which they spent time in the nearby worker accommodations to connect with occupants. This raised awareness on fatigue and also recognized areas of further improvement in terms of sleeping environment, food choice, and adherence to work/rest schedule. Secondly, real-time review of the data identified specific jobs and crafts in which compliance with the FRMP was lacking, and interventions to improve compliance were immediately implemented. Finally, simple, focused, visually-based communication on indicators and risk of fatigue was provided to the workers regularly, providing ongoing education on the importance of quality sleep and prevention of fatigue. Together, these efforts resulted in successful management of fatigue and its adverse effects.

Summary: The most important criterion of success of the TA was to deliver a Goal Zero TA with no harm to people and no leaks. This meant caring for people and plant so that each and every worker returned home safely to their families and loved ones. To achieve this, leaders at Pearl GTL collaborated with Shell Health to develop an FRMP to manage the risk of fatigue during the TA, and data were collected and analyzed to assess compliance throughout the TA. In an environment where risk of fatigue and its subsequent harmful events was high, mitigation of the risk was successful. Workers were highly compliant with FRMP requirements, and the risk of fatigue was managed successfully during the TA through a strong leadership commitment, long-term planning and collaboration between Pearl GTL and Shell Health.