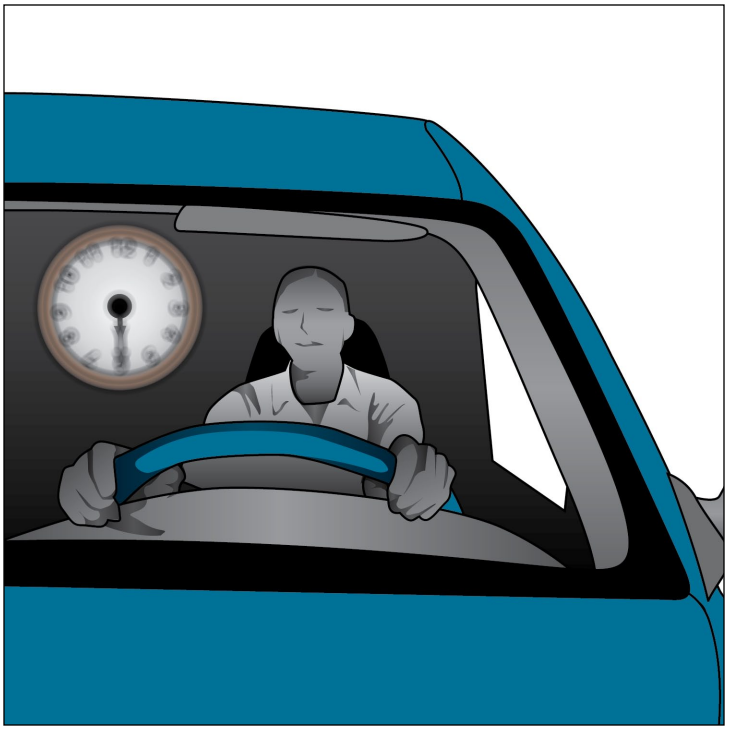
These human factors bulletins focus on how workers interact with their work environments and how those factors influence the decisions and actions of the workers. Identifying these factors can help to prevent similar accidents.

Work schedules and fatigue

What happened?

A student was offered employment at an employer's site that required him to commute 2.5 hours each way. After working two day shifts, the student was assigned to work the night shift to cover for another worker. At the end of his eighth consecutive shift, he left the worksite and started to drive home. Shortly after, his car left the highway and he was killed in the crash. The police report concluded that he failed to negotiate a curve and was likely asleep or looking away from the road at the time of the accident.



From a human factors perspective, what can we learn from this incident?

Most people need 7.5–8.5 hours of sleep each 24-hour day. Sleep loss built up slowly over several nights can be as harmful as sleep loss in one night. Both produce a decline in performance such as slower reaction times, failure to respond to changes, and the inability to concentrate and make reasonable judgments.

Research that tested a fatigued state from continuous hours of wakefulness against blood alcohol levels concluded that[1]

- 17 hours awake is equivalent to a blood alcohol content of .05
- 21 hours awake is equivalent to a blood alcohol content of .08 (the legal limit in Canada)
- 24–25 hours awake is equivalent to a blood alcohol content of .10

In addition to fatigue caused by shortened periods of sleep, the quality of sleep during the day is not the same as during the night. People have a natural tendency to be awake during the day. Every person has

[1] Dawson, D., and Reid, K. (1997). "Fatigue, alcohol and performance impairment." *Nature* 388, 235.

a circadian rhythm—an internal biological time clock. This rhythm follows body temperature and changes our level of mental alertness. Typically, in a 24-hour period, our alertness is reduced between the hours of 3:00 and 5:00 during the day and the night. So during night shifts, workers are fighting against their natural rhythm to stay awake at a time when they would naturally sleep.

In this incident, the worker's schedule did not allow enough time for both commuting and sufficient sleep. There were several factors that would have contributed to the student's fatigued state. He had built up over 12 hours of sleep debt during the eight days. Because of the six night shifts, his sleep would have been of a lesser quality since he was sleeping during the day. Finally, by the time he started to drive home, he had been awake for over 19 hours. This would have placed him in the dangerous position of having a performance level close to an equivalent legal impairment.

Understanding human factors helps avoid workplace accidents

We live in a society where fatigue is a serious workplace health and safety issue. Everyone can become fatigued. The best way to cope with fatigue is to prevent its onset. The continuous number of hours worked and the time of day worked (day vs. night shifts) need to be considered when developing work schedules. The potential for accumulated or sudden sleep loss should also be considered. To manage fatigue, the entire time a worker has to be awake should be considered, not just the time spent working. For example, the time spent commuting, especially for those who drive a long distance after leaving night shift. This time may add to an already long shift and increase the likelihood of fatigue impairment.

It is important to understand and recognize the signs and symptoms of fatigue and adopt prevention strategies that minimize the risk of accidents. The following web resources provide more information on fatigue and how to prevent it in the workplace.

- Enform *Guide to Safe Work: Fatigue Management* http://ww2.enform.ca/cms-assets/documents/30603-75628.fatiguebooklet2007.pdf
- *HSE Human Factors Briefing Note No. 10 — Fatigue* http://www.hse.gov.uk/humanfactors/topics/10fatigue.pdf
- National Sleep Foundation http://www.sleepfoundation.org/article/sleep-topics/shift-work-and-sleep