



## TSB BACKGROUNDER

# Fatigue in the transportation industry

Fatigue is widely recognized as a hazard in the transportation industry that must be managed. Mitigating the risk of fatigue requires understanding it and implementing effective countermeasures.

According to scientific research,<sup>1</sup> to help prevent the risk of fatigue, sleep should ideally occur at night in a period of seven to nine continuous hours, so that all stages of sleep occur during each sleep period. Because of the daily (circadian) rhythm, the human body is physiologically ready for sleep at night and for activity during the day. No matter the amount of rest we get, overall performance and cognitive functioning are at their worst during the nighttime period. The body's circadian rhythm also makes any sleep that occurs during the day less restorative than nighttime sleep.

### Risk factors

Fatigue can impair human performance in ways that can lead to accidents. This is why the TSB routinely investigates if fatigue was present in an occurrence, if it played a role, and if the operator had practices in place to effectively manage the associated risks.

- **Sleep disruptions**—Depending on the stage in which it occurs, sleep disruption may affect physiological functioning and/or cognitive functioning, and elevates the risk of fatigue. The risk increases when the quality or quantity of sleep has been reduced within the previous three days (acute sleep disruption) or when sleep disruptions have been sustained for periods longer than three consecutive days (chronic sleep disruption).
- **Continuous or prolonged wakefulness**—Being awake for more than 17 hours heightens the risk of fatigue.
- **Circadian rhythm effects**—Changing sleep-wake patterns too quickly, or working at a time of day at which our body is expecting sleep can cause circadian rhythms to desynchronize, leading to performance impairments.
- **Sleep disorders**—Many disorders result in higher than normal levels of fatigue if they are untreated or not managed properly. Three of the more common sleep disorders are insomnia, obstructive sleep apnea and periodic limb movement disorder.
- **Individual factors**—A person's ability to obtain restorative sleep may be influenced by individual factors, including certain illnesses, the use of drugs or medication that affect sleep or sleepiness, or characteristics such as morningness/eveningness, or one's capacity to nap.

### Mitigation strategies

To effectively manage the risks of fatigue in the transportation industry, organizations must adopt a proactive approach that includes, as a minimum, compliance with regulations and an education program that enables employees to identify fatigue, and take preventative measures that go beyond the regulations.

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<sup>1</sup> M. Hirshkowitz, K. Whiton, S. M. Albert, et al., "National Sleep Foundation's Sleep Time Duration Recommendations: Methodology and Results Summary," *Sleep Health: Journal of the National Sleep Foundation*, Vol. 1, Issue 1 (March 2015), pp. 40–43.

## Work/rest requirements

To minimize the risk of fatigue, the following regulations apply in the transportation industry:

- Section 320 of the Marine Personnel Regulations<sup>2</sup> requires that the master and every crew member of Canadian vessels have
  - (i) at least six consecutive hours of rest in every 24-hour period, and
  - (ii) at least 16 hours of rest in every 48-hour period; and

The master shall also ensure that

- (b) not more than 18 hours but not less than six hours elapse between the end of a rest period and the beginning of the next rest period.
- Subsection 5.1.1 of the Work/Rest Rules for Railway Operating Employees<sup>3</sup> requires that
  - The maximum continuous on-duty time for a single tour of duty operating in any class of service, is 12 hours, except work train service for which the maximum duty time is 16 hours. Where a tour of duty is designated as a split shift, as in the case of commuter service, the combined on-duty time for the two on-duty periods cannot exceed 12 hours.
- According to the *Canadian Aviation Regulations* (CARs), subsection 700.16(1),<sup>4</sup>
  - Subject to subsections (5) and (7), no air operator shall assign a flight crew member for flight duty time, and no flight crew member shall accept such an assignment, if the flight crew member's flight duty time will, as a result, exceed 14 consecutive hours in any 24 consecutive hours. Where the flight is conducted under Subpart 4 or 5 using an aircraft other than a helicopter, flight duty time shall include 15 minutes for post-flight duties.

## Education and awareness

The prevention of fatigue in the workplace is a shared responsibility between an organization and its employees.

An organization can help prevent fatigue by

- educating employees on the causes and mitigation of fatigue;
- defining appropriate policies and procedures;
- ensuring that the working environment and scheduling system minimize the risk of fatigue;
- striving for continual improvement in reducing the risk of fatigue.

Employees can help prevent fatigue by

- recognizing the signs of fatigue in themselves and in co-workers;
- taking action to ensure that fatigue arising from activities inside or outside of work does not lead to performance issues;

<sup>2</sup> Transport Canada, SOR/2007-115, *Marine Personnel Regulations* (last amended 20 August 2013), Part 3: Maritime Labour Standards, section 320: Minimum and Maximum Periods.

<sup>3</sup> Transport Canada, TC O-0-140, *Work/Rest Rules for Railway Operating Employees* (last amended February 2011), subsection 5.1.1.

<sup>4</sup> Transport Canada, SOR/96-433, *Canadian Aviation Regulations* (last amended 27 June 2018), subsection 700.16(1).

- making effective use of appropriate countermeasures if or when fatigue occurs, e.g., consuming caffeine; turning on a bright light; engaging in exercise; exposing oneself to intermittent loud noise; getting fresh (cool) air; engaging in conversation.

## Current fatigue management tools

### Marine sector

Fatigue management and awareness training materials were developed for marine pilots in response to TSB Recommendation M96-18. These materials include the *Fatigue Management Guide for Canadian Marine Pilots* (TP 13959) and the *Trainer's Handbook* TP 13960.

On 31 May 2018, the TSB issued Recommendations M18-01 and M18-02 to help ensure that watchkeepers whose work and rest periods are regulated by the *Marine Personnel Regulations* have the tools needed to recognize and address the risks of fatigue (see the backgrounder "New and previous TSB recommendations to address the risk of fatigue in the marine sector").

The United States Coast Guard has developed a Crew Endurance Management System to assist in managing the risk factors that can lead to human error and performance degradation in maritime work environments.

### Rail sector

Transport Canada guidance material (*Fatigue Management Plans: Requirements and Assessment Guidelines*) helps companies develop fatigue management plans that meet the industry's *Work/Rest Rules for Railway Operating Employees*.

In 2017, Transport Canada announced its intent to amend the rail safety regulatory framework,<sup>5</sup> which may result in amendments to the *Work/Rest Rules for Railway Operating Employees* and the *Railway Safety Management System Regulations, 2015* or the development of new regulations to address fatigue in the rail industry.

### Aviation sector

Transport Canada provides guidance, in the form of a toolbox, to companies that adopt Fatigue Risk Management Systems (FRMS) in accordance with the CARs.

In 2017, Transport Canada proposed amendments to the CARs to mitigate the effects of fatigue with new hours of work and rest provisions.<sup>6</sup>

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<sup>5</sup> Government of Canada, *Canada Gazette*, Part I, Vol. 151, No. 45 (11 November 2017), Transport Canada, Notice of intent to amend Canadian rail safety regulations.

<sup>6</sup> Government of Canada, *Canada Gazette*, Part I, Vol. 151, No. 26 (01 July 2017), Transport Canada, *Regulations Amending the Canadian Aviation Regulations (Parts I, VI and VII — Flight Crew Member Hours of Work and Rest Periods)*.