Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

How shift scheduling practices contribute to fatigue amongst freight rail operating employees: Findings from accident investigations

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Canada

Outline

- Background
- Method
- Report themes
- Example occurrences (2)
- Conclusions

Role of TSB *vs.* Transport Canada

TSB – Independent agency…

- Conducts independent investigations,
- Identifies safety deficiencies,
- Makes recommendations,
- Reports publicly.

Transport Canada – Federal regulator…

- Promotes safe and secure, efficient and environmentally responsible transportation system.

Background

- Fatigue…poor concentration, easily distracted, impairs problem-solving, ↑ mistakes, ↑ risk-taking
  - Slows reaction time to safety alarms (Hidebrandt et al., 1974)
  - Impairs conformance to train driving requirements (Dorrian et al., 2007)
- Pervasive…
  - 7 to 8 hours of sleep per night to feel well-rested…30% of Canadians report < 6 hours of sleep per night (Morin et al., 2011)
  - 60% report feeling tired "most of the time"

Background

Fatigue in railway operating employees:

- TCRC (union) web survey - 2014:
  - 85% of ~1,100 freight operating employees reported having felt so tired that work was affected
  - 76% reported having "drifted into sleep" while working

Shift scheduling practices can contribute to fatigue by:

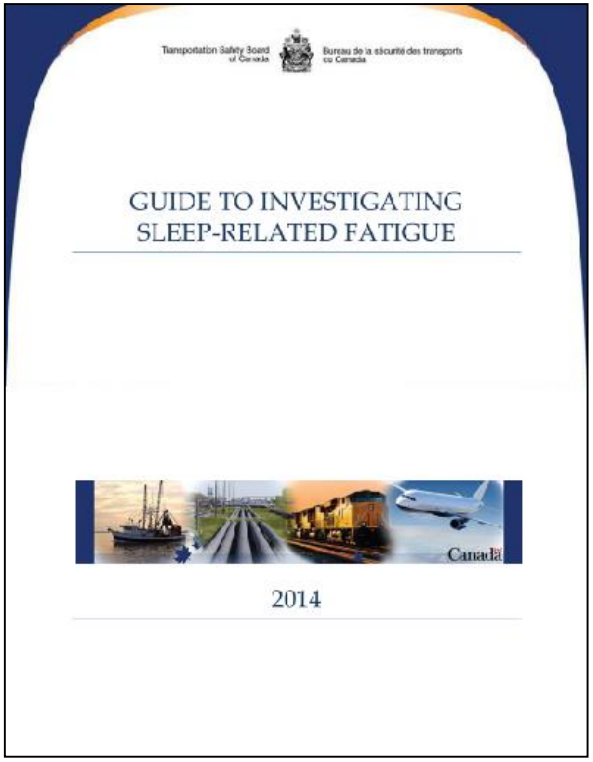
1. restricting opportunities to obtain sleep;
2. requiring extended periods of wakefulness;
3. disrupting daily (circadian) rhythms.

Background

Transport Canada's Railway Safety Management System (SMS) regulations (2015):

- requirements to apply principles of fatigue science to shift scheduling practices.
- currently auditing railways' SMS before taking further measures to manage railway crew fatigue
- audits scheduled up to 2021

Background: Investigating for fatigue



Background: Investigating for fatigue

- ~1,200 to 1,400 railway occurrences reported to TSB each year under mandatory reporting
- Only ~1% of these are investigated fully and result in published TSB report
- Difficult to estimate prevalence of fatigue-related accidents
- Review of investigations where fatigue played a role can improve understanding

Method

- TSB database search of reports from 1995 to 2014
  - Also reviewed anonymous reports (2011-2014)
- 18 reports → fatigue of freight rail operating employees was causal, contributing, or risk finding
- Represents ~20% of rail investigations where human factors issue was primary cause
- Findings / recommendations explored & grouped according to theme

Results - Report themes:

1. Disruption of normal sleep cycle;
2. Insufficient rest periods between shifts;
3. Extended periods of continued wakefulness due to shift length;
4. Pressures on crews not to refuse shifts;
5. Varied and unpredictable railway shift scheduling;
6. Ineffective fatigue countermeasures; and
7. Cumulative effects of working extended hours over long-term.

Occurrence R03W0169 (Carlstadt, ON)

Report themes (3):

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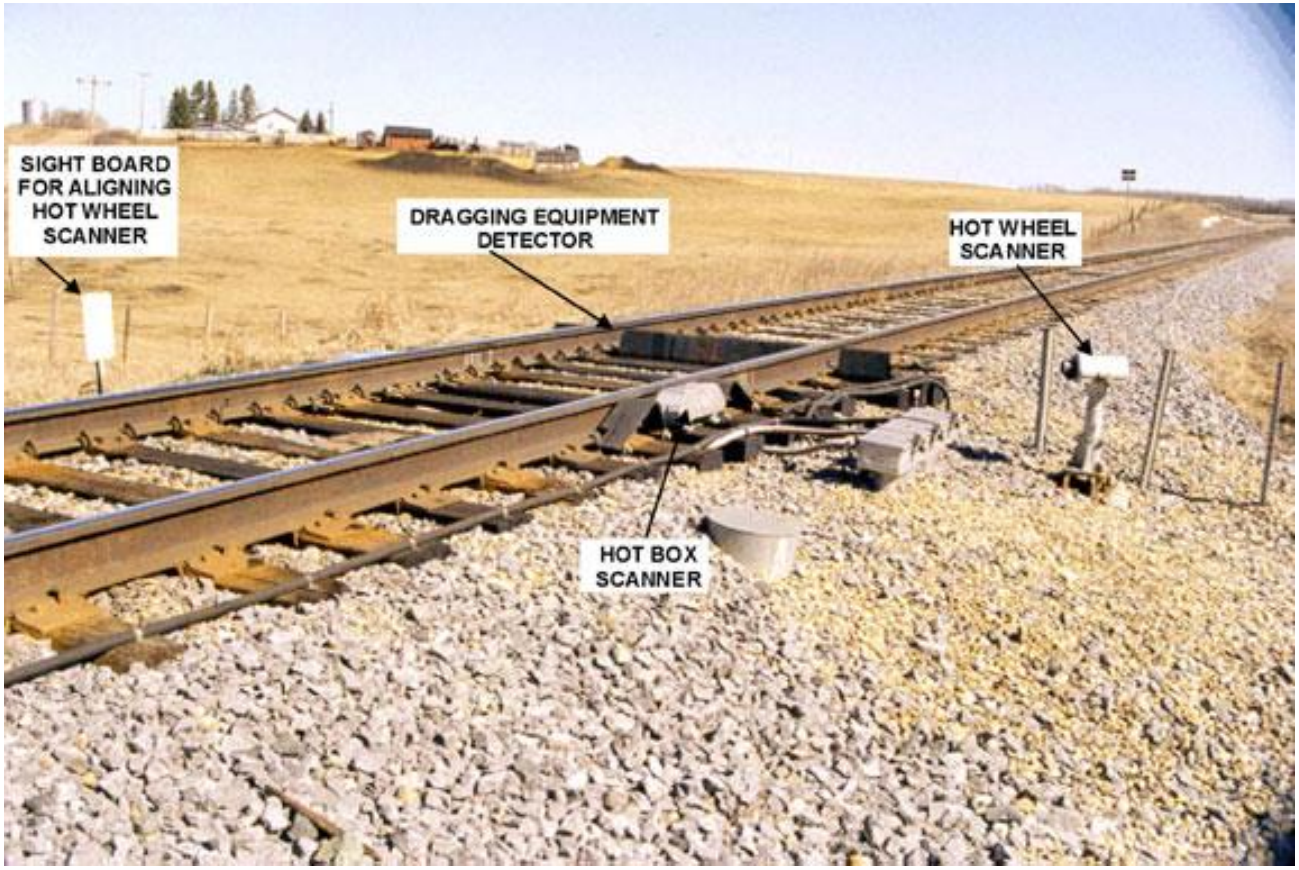
Occurrence R03W0169 (Carlstadt, ON)

- 19 October 2003 at 2318
- Freight train travelling from Coquitlam, British Columbia to Toronto, Ontario on main track
- Locomotive engineer and conductor → met fitness for duty requirements, familiar with territory
- Train movements supervised by rail traffic controller (RTC)
- Shift scheduling system based on *Work/Rest Rules for Rail Operating Employees (2002)*
- Crews typically called 2 hours prior to shift
- Crews typically avoid booking rest at 'away terminal'

Occurrence R03W0169 (Carlstadt, ON)



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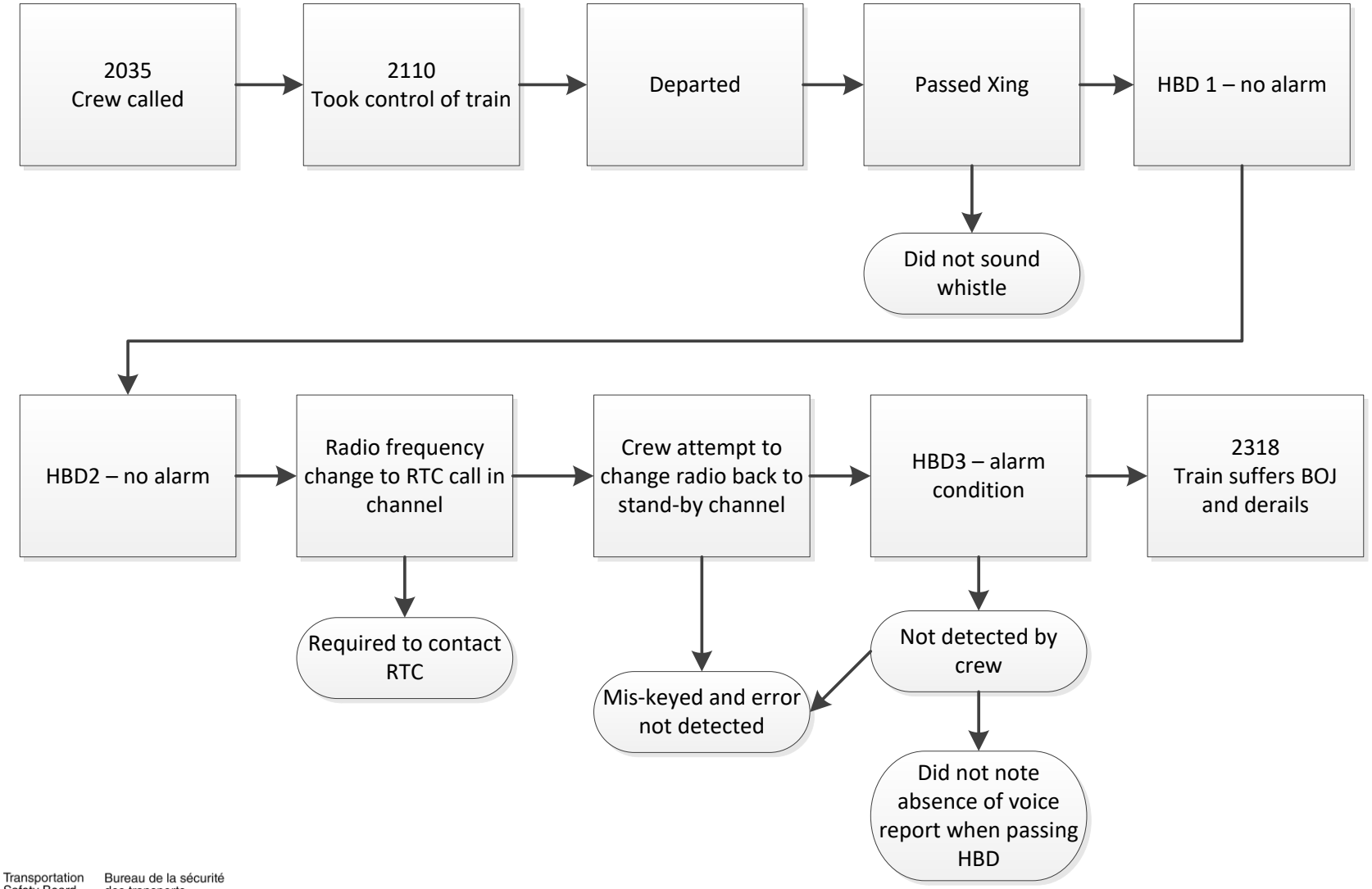

Occurrence R03W0169 (Carlstadt, ON)

Sleep-Wake History

Key: ***AD*** = awake and on duty, ***A*** = awake and off duty, ***S*** = main sleep period, and ***SN*** = nap.

Home Base Time ->		0000 0100	0100 0200	0200 0300	0300 0400	0400 0500	0500 0600	0600 0700	0700 0800	0800 0900	0900 1000	1000 1100	1100 1200	1200 1300	1300 1400	1400 1500	1500 1600	1600 1700	1700 1800	1800 1900	1900 2000	2000 2100	2100 2200	2200 2300	2300 0000
Day	Date																								
Fri	17 OCT	S	S	S	S	S	S-A 0600	A	A	A	A	Call 1011	A	Duty 1200	AD	AD	AD	AD	AD	OFF 1830	SN 1930	SN	Wake 2130	Duty 2230	AD
72 to event - (8 S / 16 A)→		…7 hours sleep						13.5 hours awake - 6.5 on duty													2 hour nap		Next line	
Sat	18 OCT	AD	AD	AD	AD	AD	AD	AD	AD	AD	OFF 0915	A	SN 1100	SN	S-A 1400	A	A	A	A	A	A	A	A	S 2200	S
48 to event - (5 S /19 A)→		13.5 hours awake - 10:45 on duty (17.25 duty in 24 hours)											3 hour nap			8 hours awake - off duty								Next line	
Sun	19 OCT	S	S	S	S	S-A 0530	A	A	A	A	A	Call 1039	Duty 1130	AD	AD	AD	AD	AD	OFF 1730	SN 1800	Wake 1930	Call 2035	Duty 2110	AD	X 2318
24 to event - (9 S / 15 A)→		7.5 hours sleep						12.5 hours awake - 6 hours on duty												1.5 Nap	**3:48 awake to occurrence**				

Occurrence R03W0169 (Carlstadt, ON)

- 3 crew errors were “consistent with fatigue-related performance impairment” (e.g., decreased vigilance, disregard of warning signs)

2 Findings as to risk:

- The Work/Rest Rules for Rail Operating Employees permit consecutive hours of wakefulness in excess of 18 hours with no scheduled rest, which increases the risk of fatigue-related errors and accidents.
- The nature of rail operations requires crew members to work variable, unpredictable schedules, often for their entire working lives. Unpredictable schedules increase the probability that train crews will be working in a chronically fatigued state, which can lead to errors associated with fatigue.

Occurrence R07E0129 (Peers, AB)

Report themes (3):

1. disruption of normal sleep cycle;
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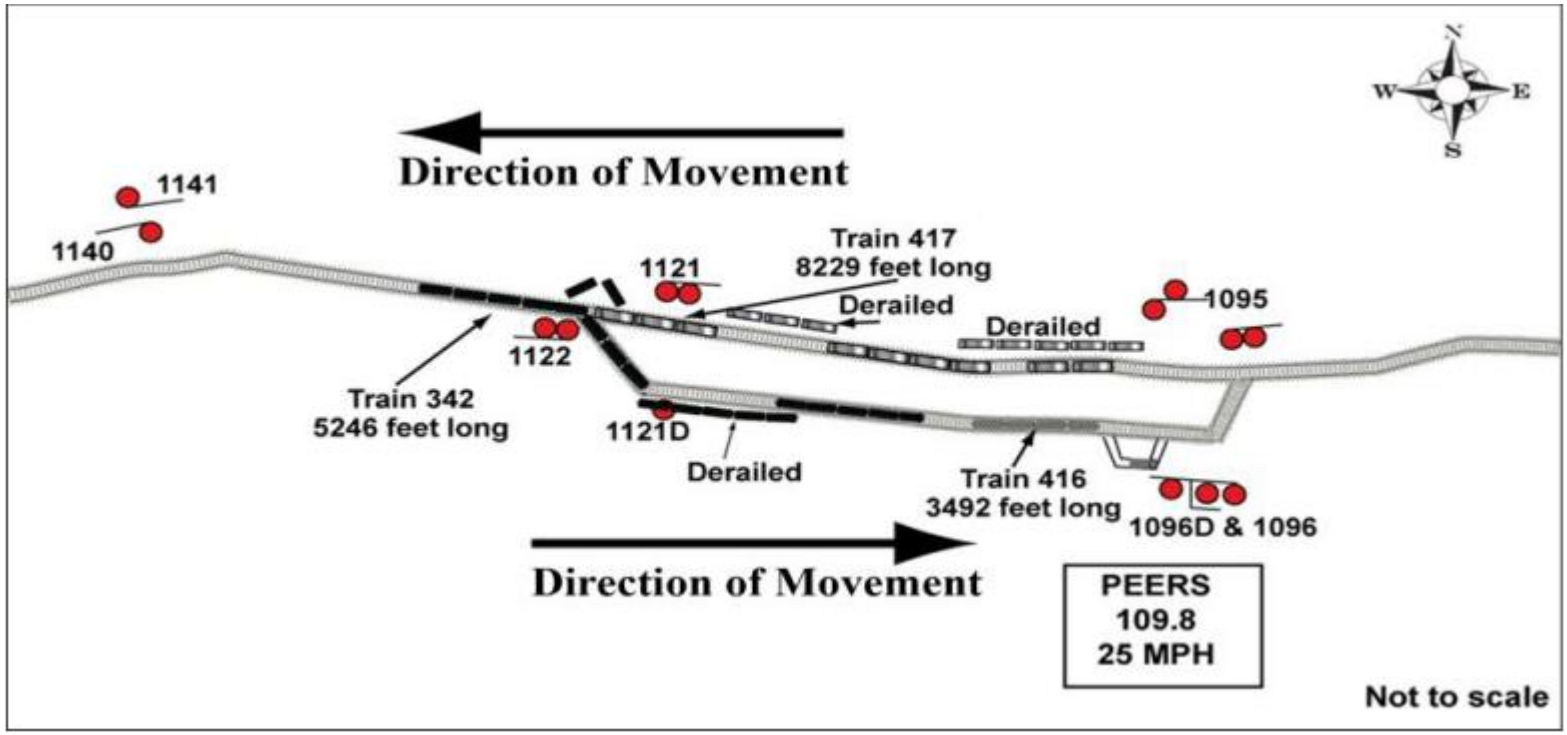

Occurrence R07E0129 (Peers, AB)

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- 27 October 2007 at 0505
- Locomotive engineer → very familiar with territory
- Conductor → first trip
- Engineer had worked 15 shifts in 12 days; shifts on accident train were typically daytime
- Engineer called the crew office at least twice on day for ordering time
  - provided two (very different) estimates
  - not able to plan effective nap.

Organizational factors:

- Alertness on duty' is shared (*company / employee*) responsibility
- Railway had recently prohibited booking unfit
- En route napping not permitted
- Countermeasures:
  - education program (but not applied system-wide) and
  - specific trains

Occurrence R07E0129 (Peers, AB)

Finding as to Causes and Contributing Factors:

- Train 417's crew was insufficiently rested to be engaged in safety-critical tasks.

Finding as to Risk:

- From time to time, fatigued train crews will feel compelled to report for work without adequate rest, creating the risk of an accident.

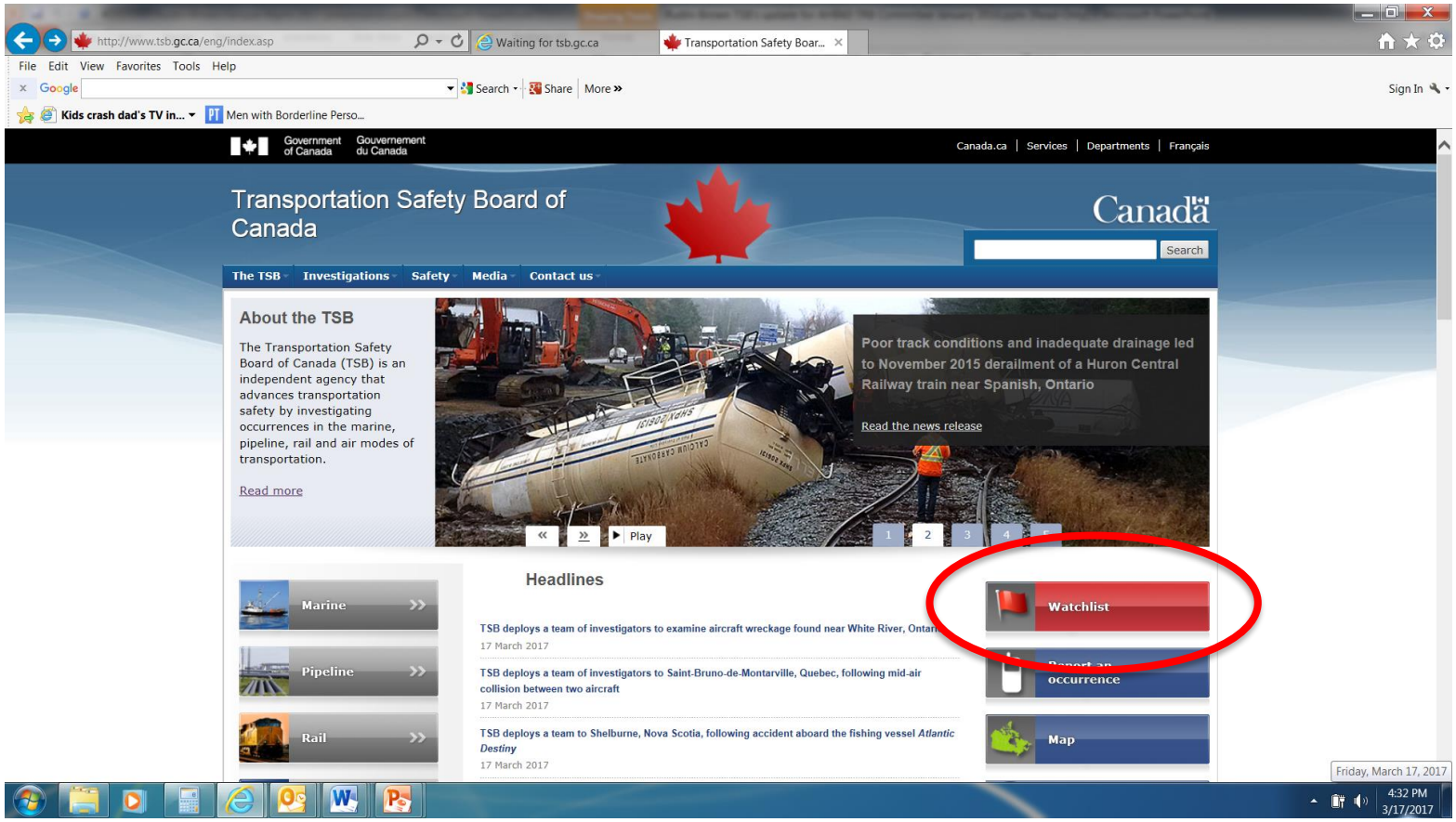
Other Finding:

- Despite previously-acquired knowledge on fatigue, the countermeasures the railway had in place were ineffective.

Conclusions

1. **Management of fatigue and shift-scheduling** in freight rail ops is complex issue → often **not conducive to circadian rhythms and sleep need**
2. **Current** shift scheduling & fatigue management **practices** may be **insufficient to mitigate risk**
3. **Transport Canada** is currently auditing railways' SMS before taking further measures to manage railway crew fatigue → audits scheduled up to 2021, but **limited resources / auditors**
4. **Review** of railway fatigue management systems required by SMS regulations **needs to be expedited**, **and further actions taken**, to improve scheduling practices and mitigate risk of fatigue

2016 TSB Watchlist issue – Fatigue management systems for train crews



Thank you!

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