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VWA Health & Safety Week

State Government Victoria

Optimising alertness and workplace performance though fatigue risk management

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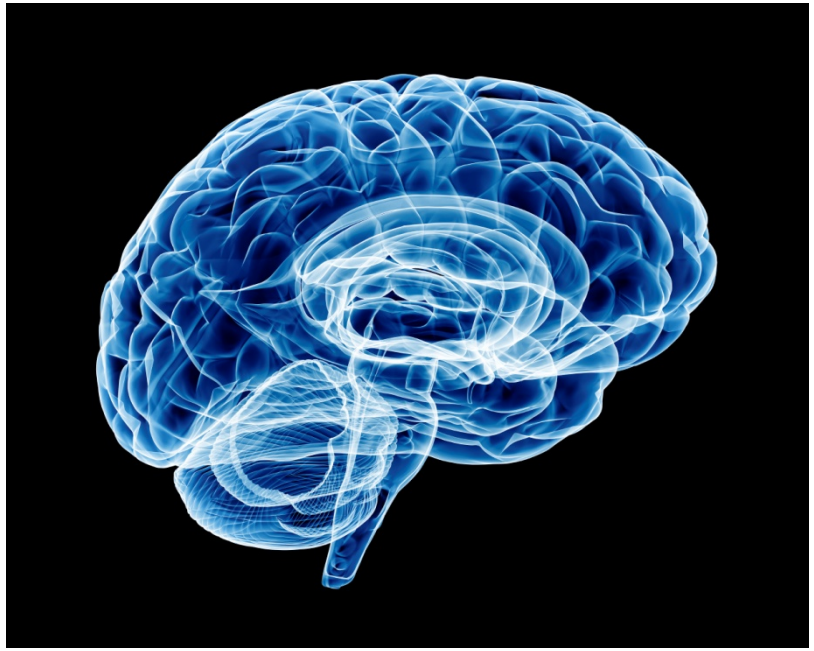
Office of the National Rail Safety Regulator
21 October 2014

Agenda

- Why sleep is fundamental to workplace safety and productivity
- How to optimise sleep and alertness
- Tools to help identify and manage fatigue-related-risk
- How health & safety representatives (HSRs) can contribute to fatigue risk management



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"If sleep does not serve an absolutely vital function, then it is the biggest mistake the evolutionary process has ever made."

Allan Rechtschaffen University of Chicago Sleep Laboratory 1978

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Fatigue, safety and productivity

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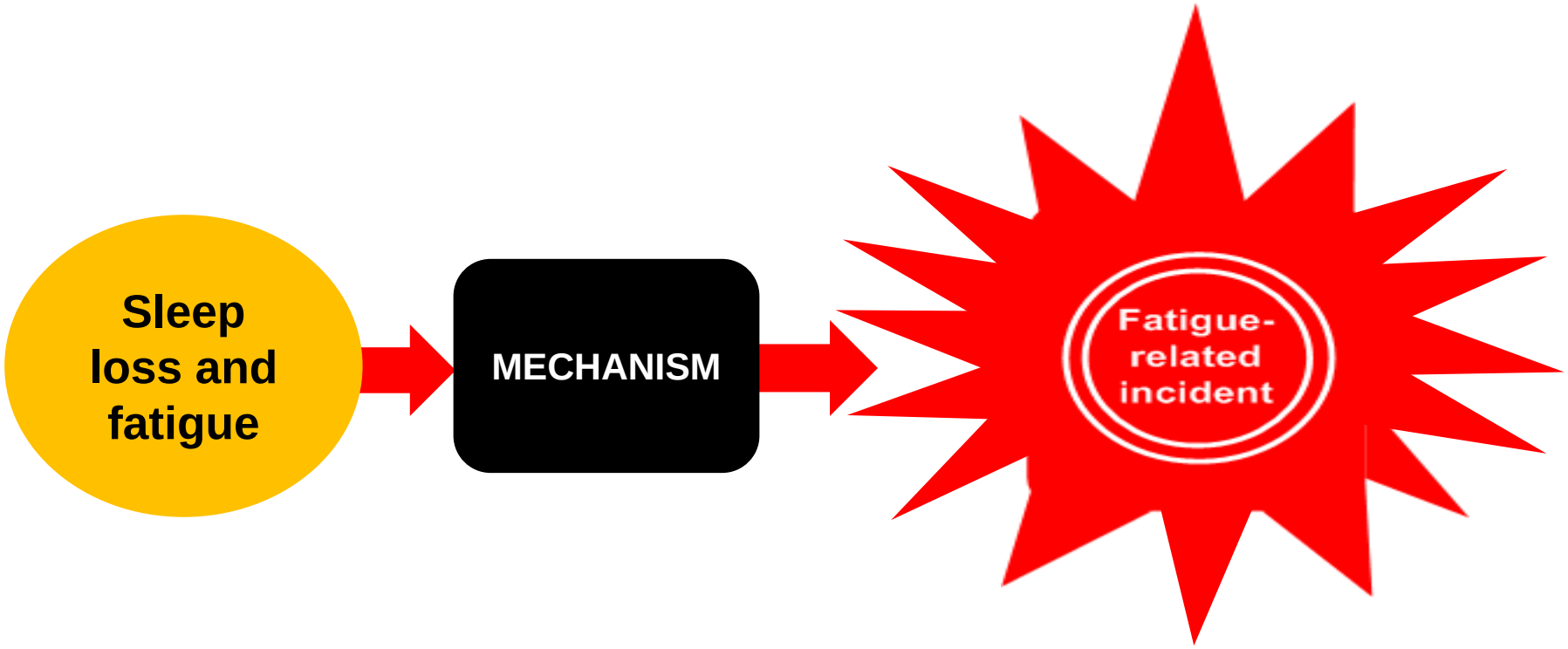

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Fatigue is an important workplace hazard

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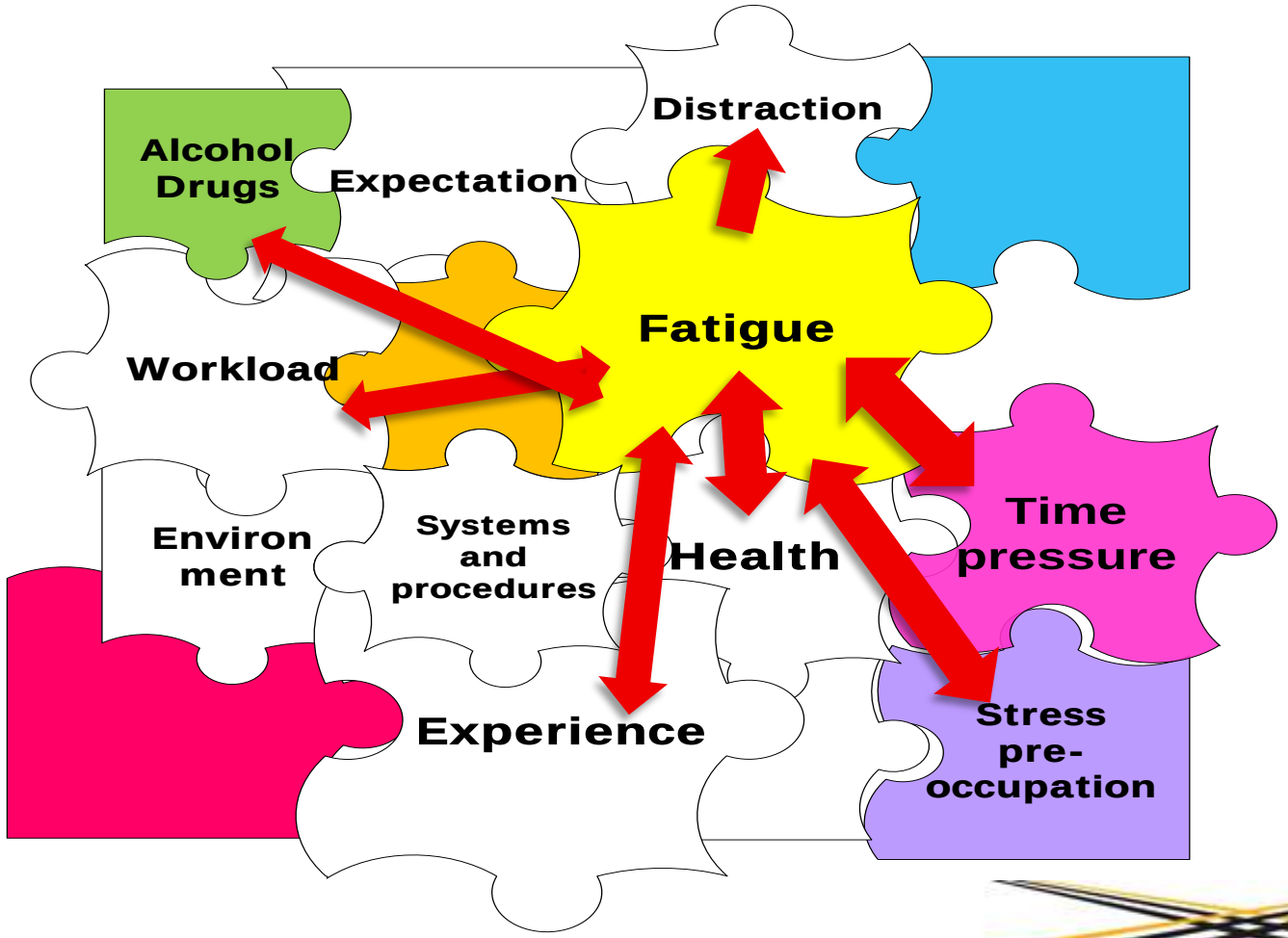
Fatigue interacts with and amplifies other factors that influence human performance



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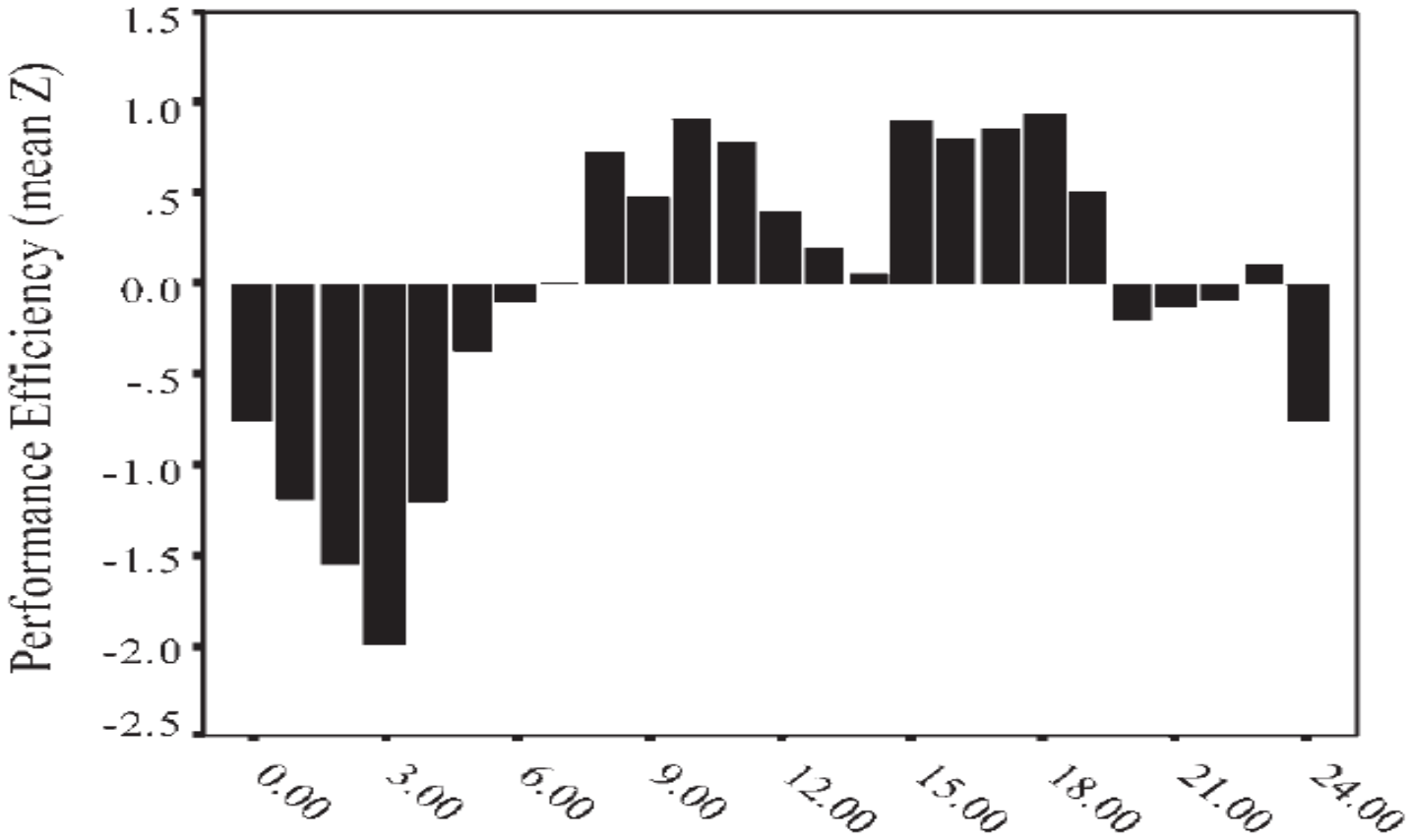
Performance is not uniform across time



Performance by time of day

Source: Folkard and Tucker 2003

Biology of sleep

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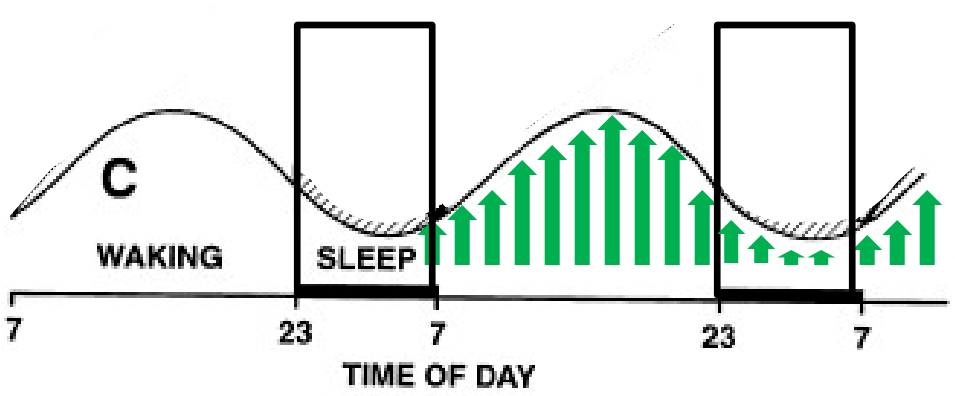
Circadian rhythm (body clock)



MODEL OF SLEEP

↑ (circadian) cyclical alerting process

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Sleep biology

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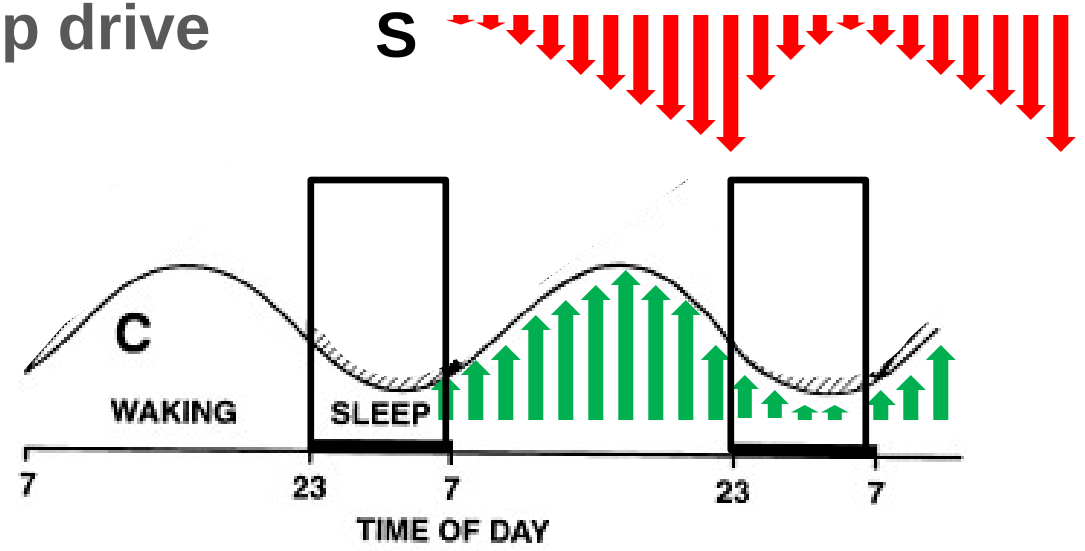
Sleep drive



MODEL OF SLEEP

Sleep process = drive to sleep with time awake

C (circadian) cyclical alerting process

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Sleep biology

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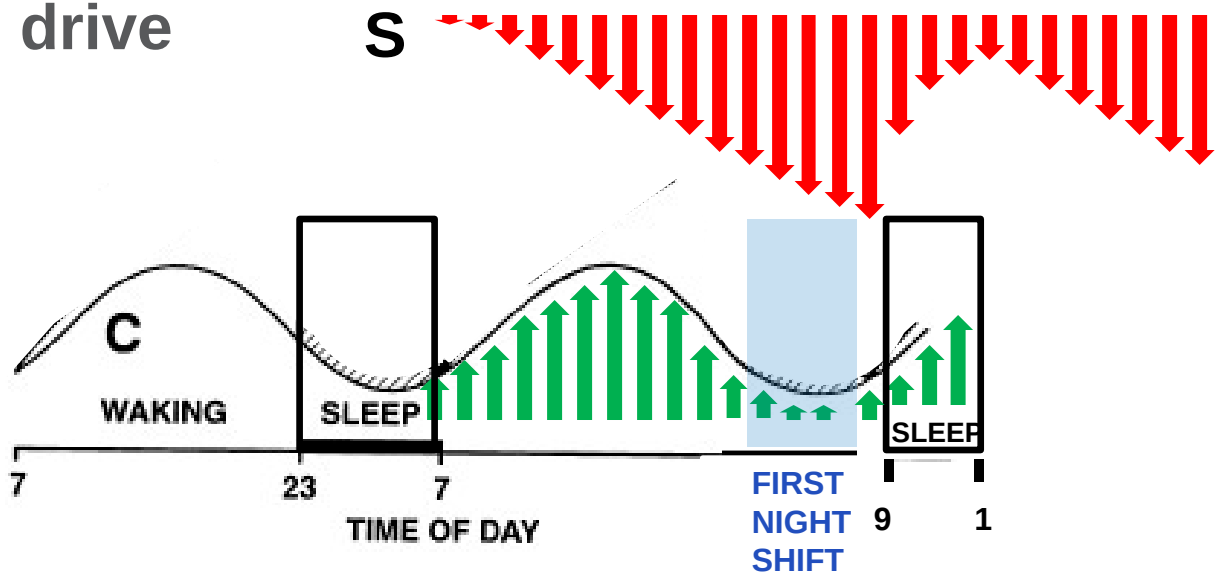
Sleep drive



MODEL OF SLEEP

Sleep process = drive to sleep with time awake

C (circadian) cyclical alerting process

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Cumulative sleep loss

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Circadian rhythm

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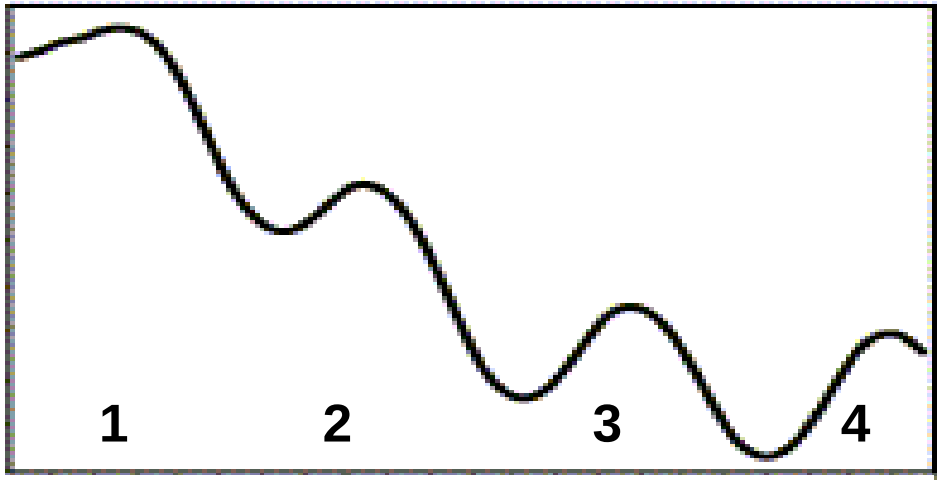
Sleep loss over days



Days of sleep loss

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Cumulative sleep loss effects

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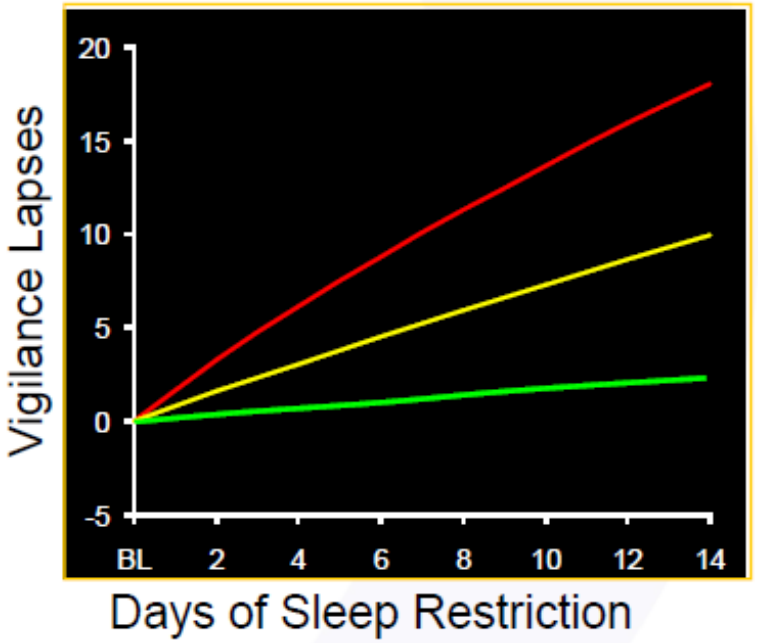
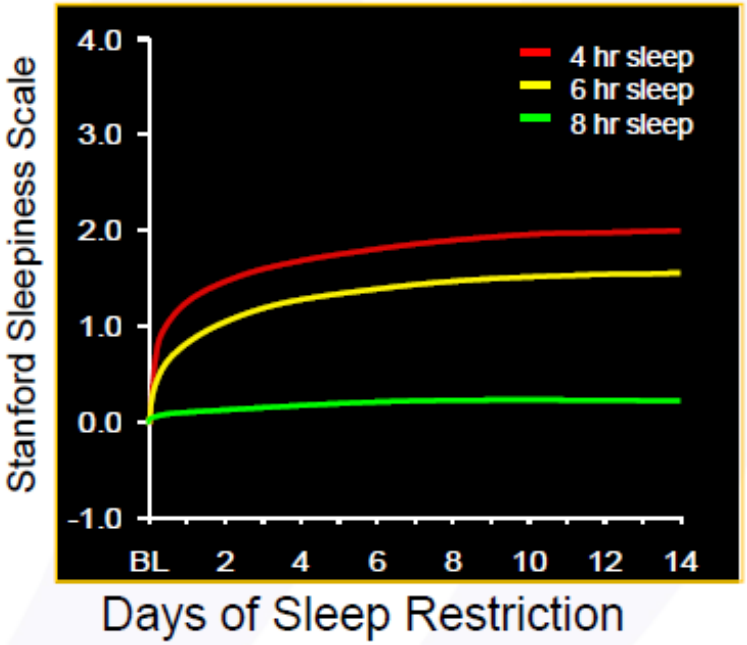
Performance deterioration



Self rated sleepiness



Source: Van Dongen et al 2003 (figures from Hursh 2010)

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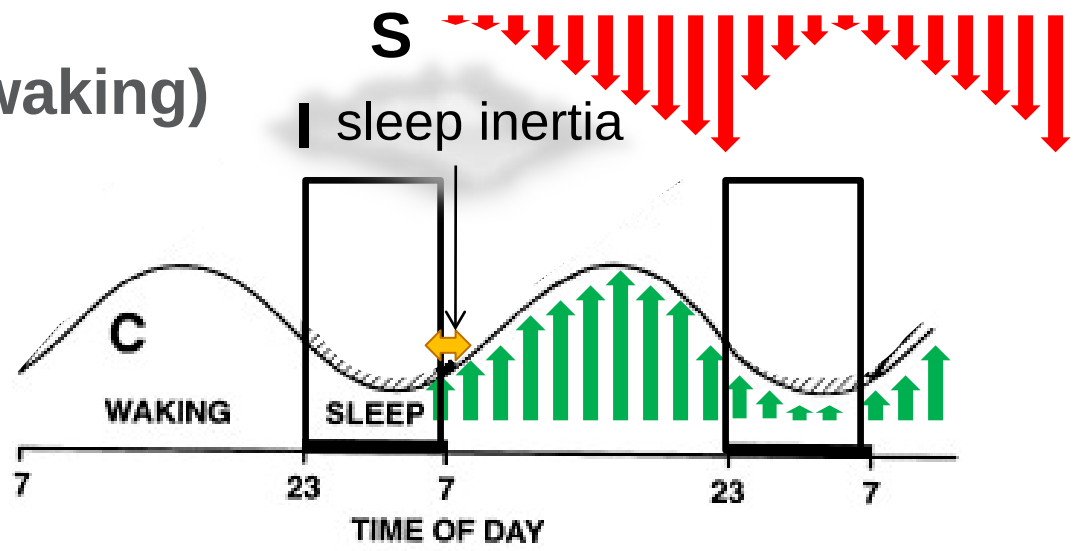
Sleep biology

Sleep inertia (grogginess on waking)



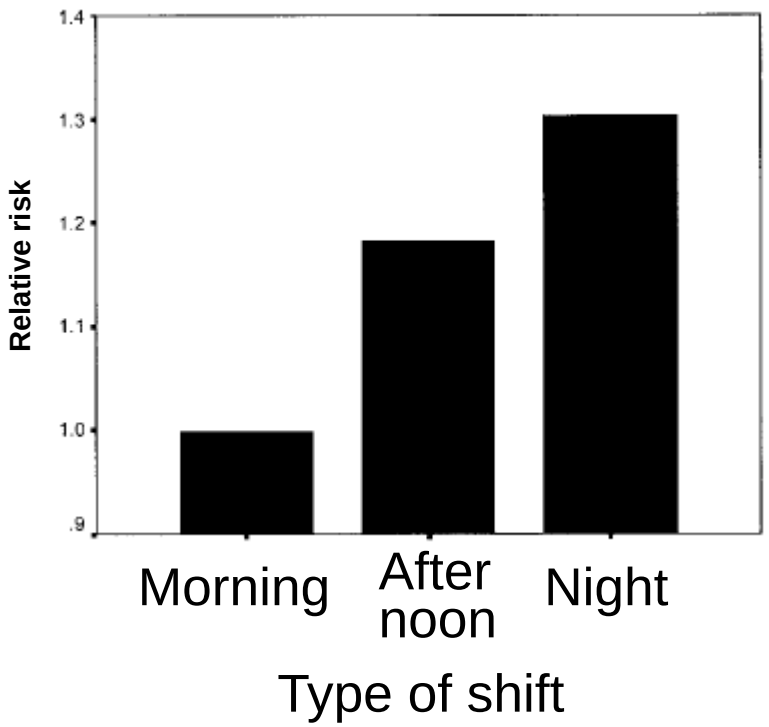
MODEL OF SLEEP

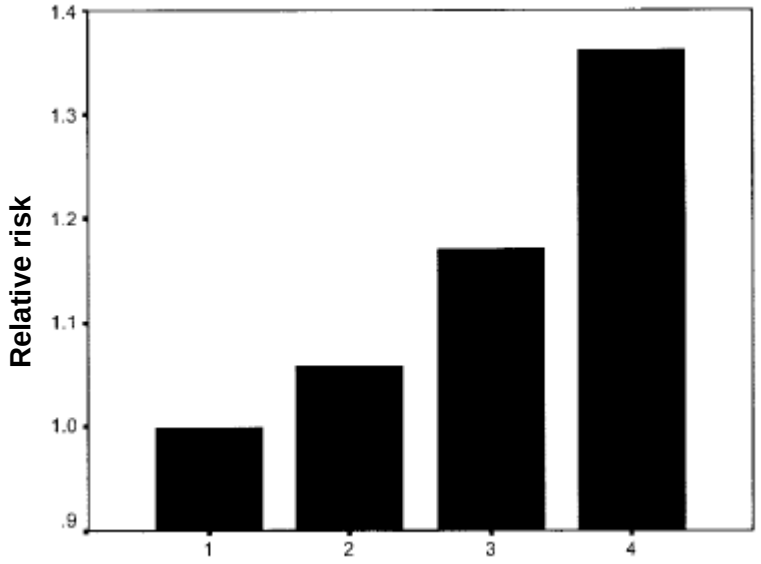
Sleep process = drive to sleep with time awake

C (circadian) cyclical alerting process

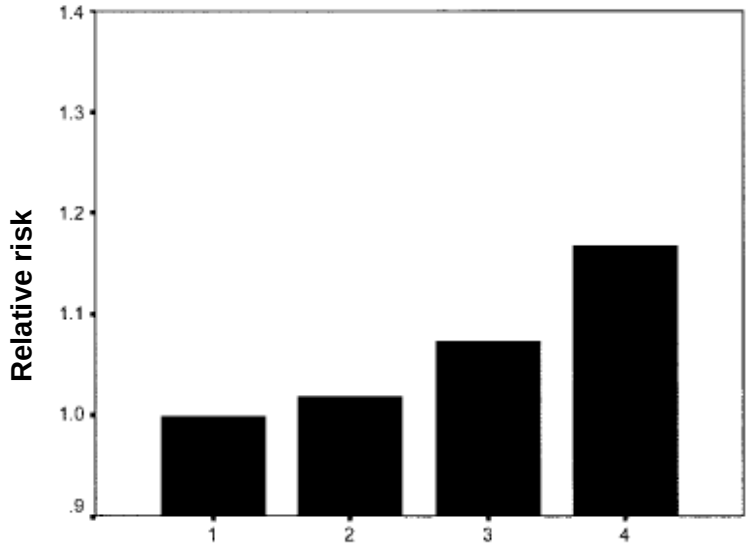
I Sleep Inertia = transient grogginess

Implications for safety:
Risk of incidents for different types of shift





Consecutive night shifts



Consecutive morning/day shifts

Source: Folkard and Akerstedt 2004

Implications for cost (US rail)

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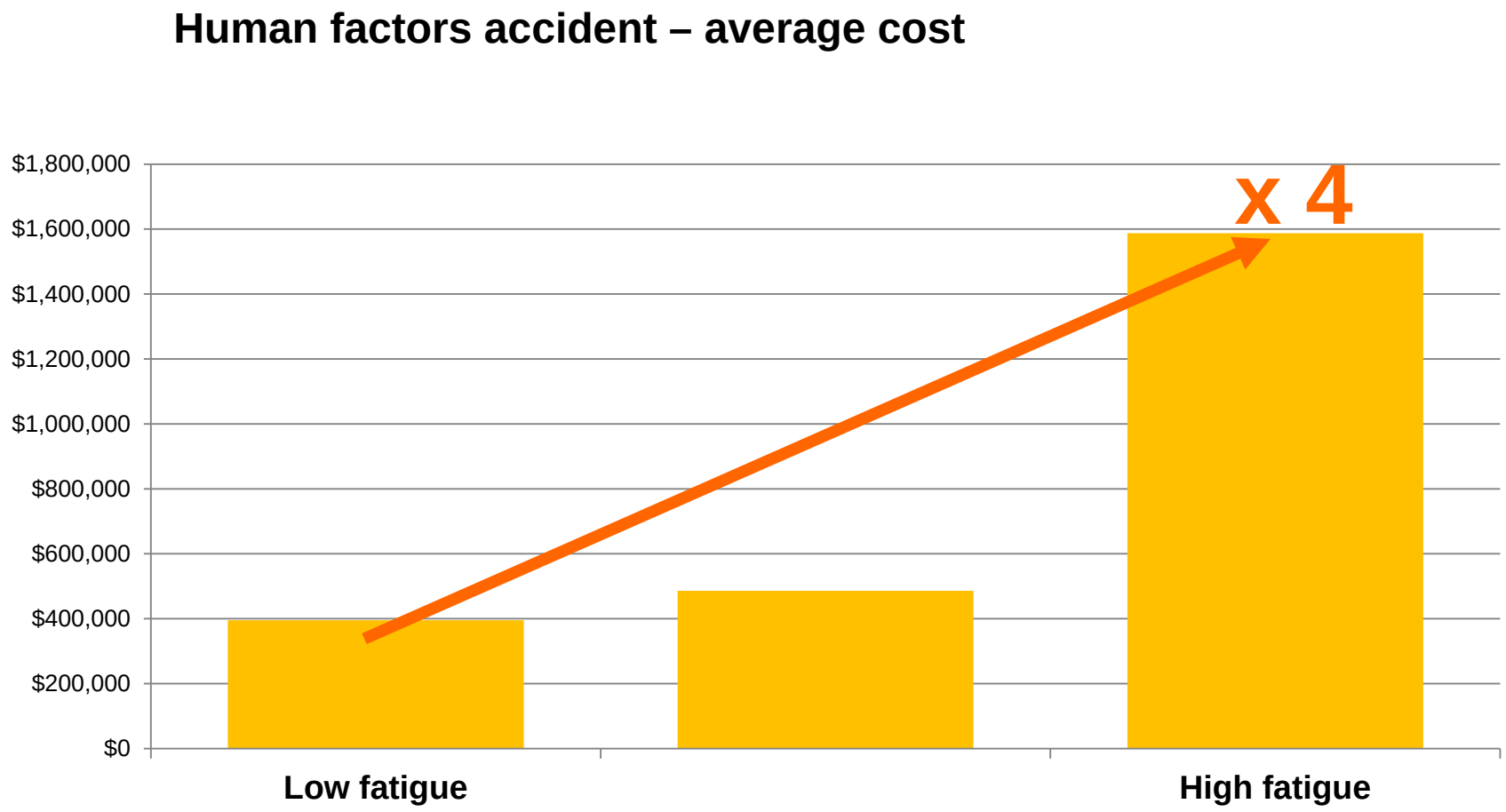

Source: US Department of Transportation Federal Railroad Administration 2011

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Implications for individual cost

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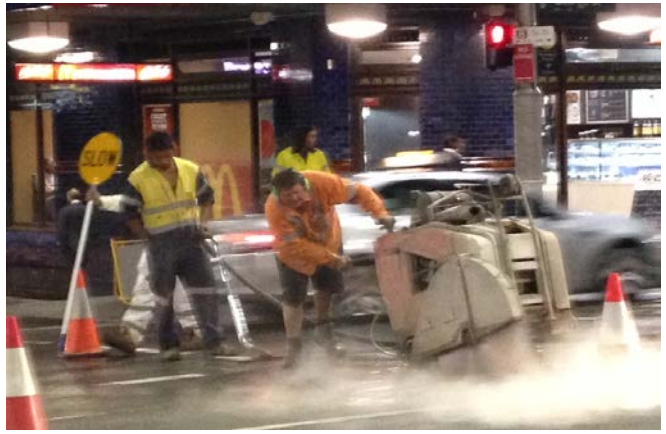
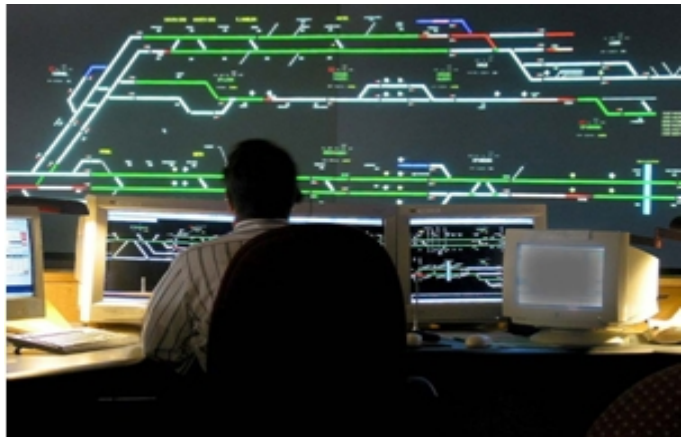
Shiftwork associated with increased risk of:



- Injury
- Heart disease
- Stroke
- Depression
- Ulcers
- Cancer
- Gastro intestinal problems
- Infertility



Other sources of fatigue

Work environment

Task dimensions

Social family factors

Sleep environment

Health and mental state

Blocks image credit: www.freeimages.co.uk'

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Fatigue effects: Attention

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- Decreased attention span
- Lapses on attention rich tasks (eg monitoring, driving)
- Easily distracted by interesting things, more engaging tasks
- Tunnelling – changes in field of attention, blind spots
- Micro-sleeps
- Sleep incapacitation

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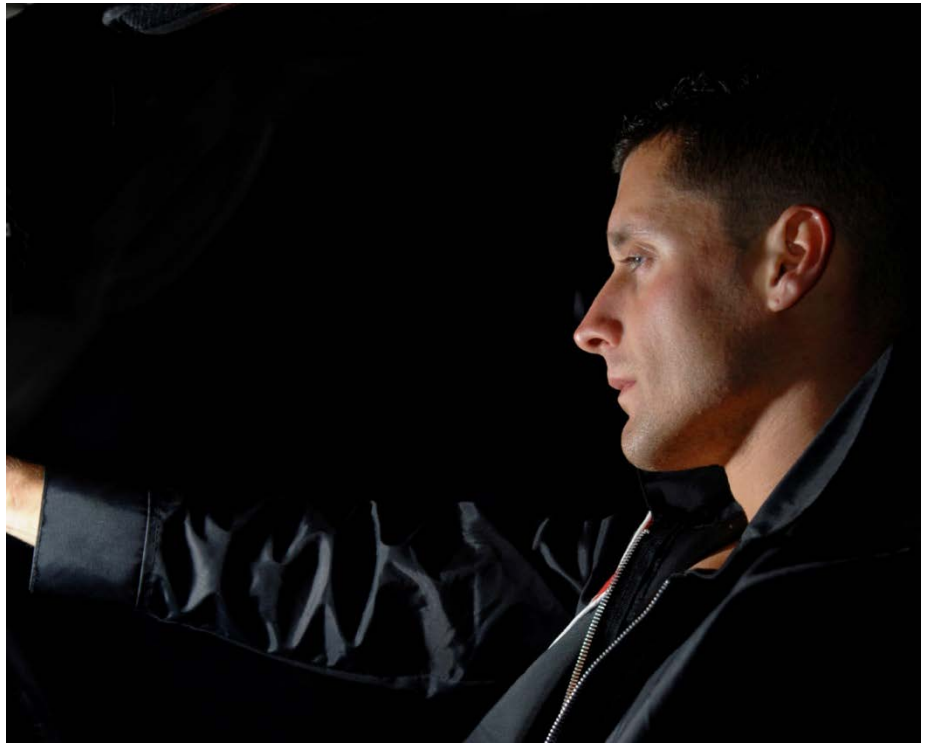
Cognition (thinking)

- Slower to interpret and integrate information
- Short term recall, working memory
- Reduced ability to learn
- Decision making:
  - Difficulty weighing up options
  - Persist with ineffective responses

Emotional control

- Feeling low and irritable
- Inability to suppress responses
- Terse communications



Motivation and insight

- Compensatory effort to maintain performance
- Initiates ok but then deteriorates
- Neglect tasks judged non essential
- Less interested in outcomes
- Less likely to pick up someone else's errors
- End goal seduction

The fatigue risk management cycle

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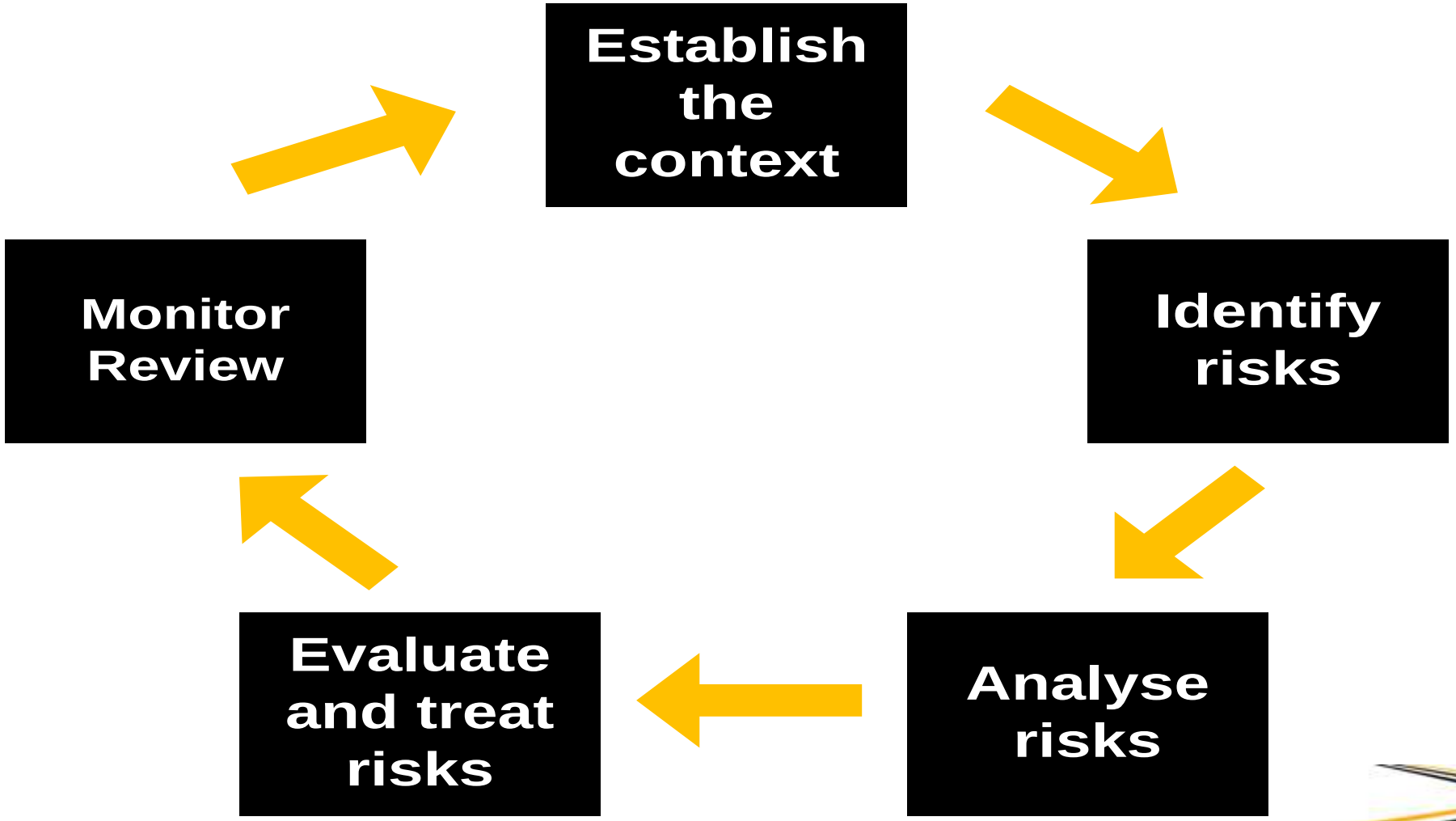

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Fatigue risk management cycle

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Establish the context

1. What activities/tasks are carried out?

2. Where? Under what conditions? (normal, degraded, emergency, nightwork)

3. What are your objectives? (business, client, worker)

Monitor Review

Identify

Ev an

yse ks

HSRs can help identify important contextual that is relevant to their designated work group.

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Fatigue risk management cycle

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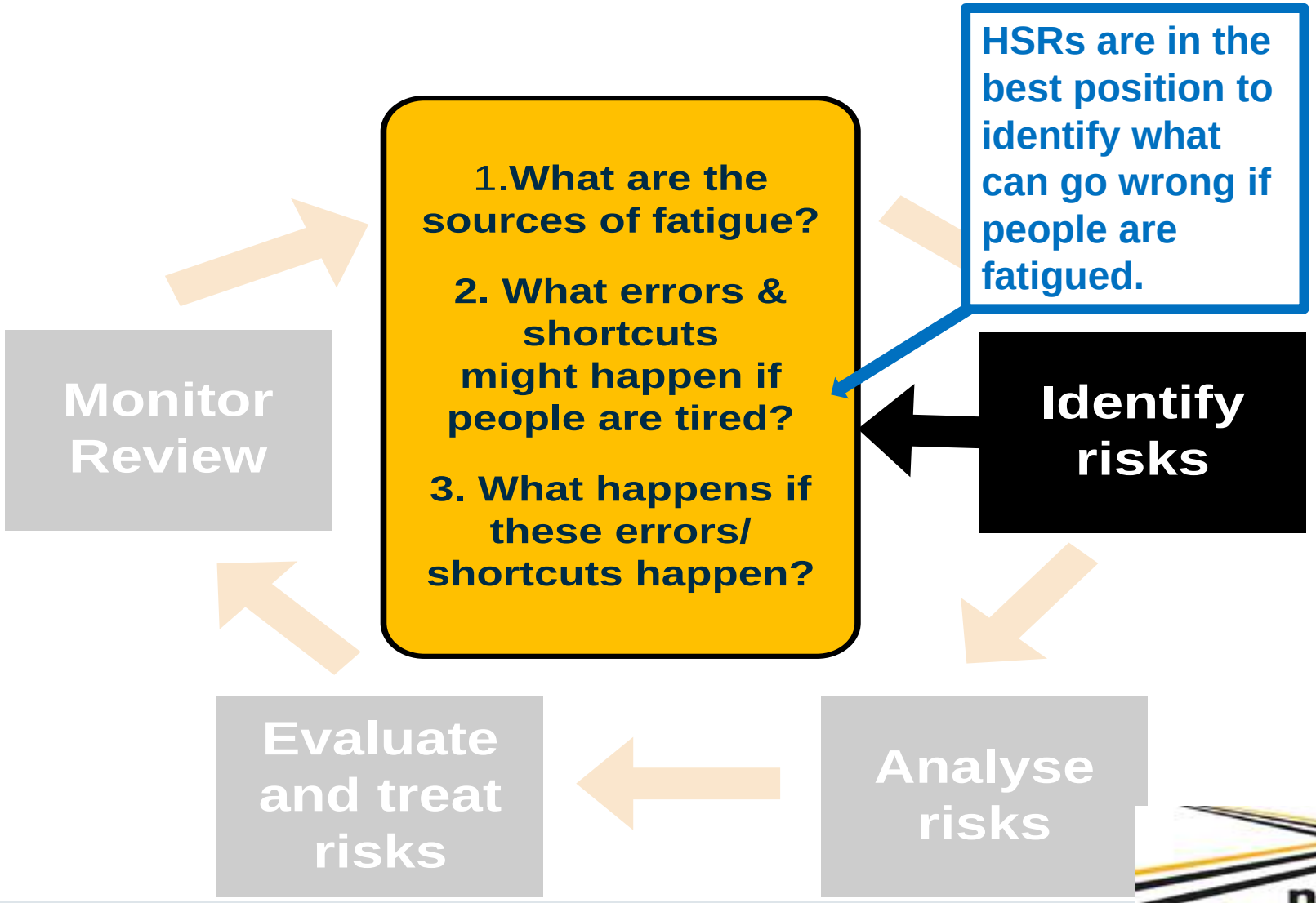
HSR Takeaway

HSRs are in the best position to identify what can go wrong if people are fatigued.



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Fatigue risk management cycle

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1. What controls are in place?
Engineered controls
Controls on work hours
Rules and procedures
Supervision, training competency

2. How effective are current controls?
Are rosters minimising fatigue?
Is our staffing right?
Do we have effective procedural controls for safety critical tasks?
How effective are engineered controls?

3. What is current level of risk?

Identify risks

Analyse risks

HSRs can provide essential input into evaluating the effectiveness of controls, particularly if there are routine short cuts because of production pressures

DIAGRAM 1

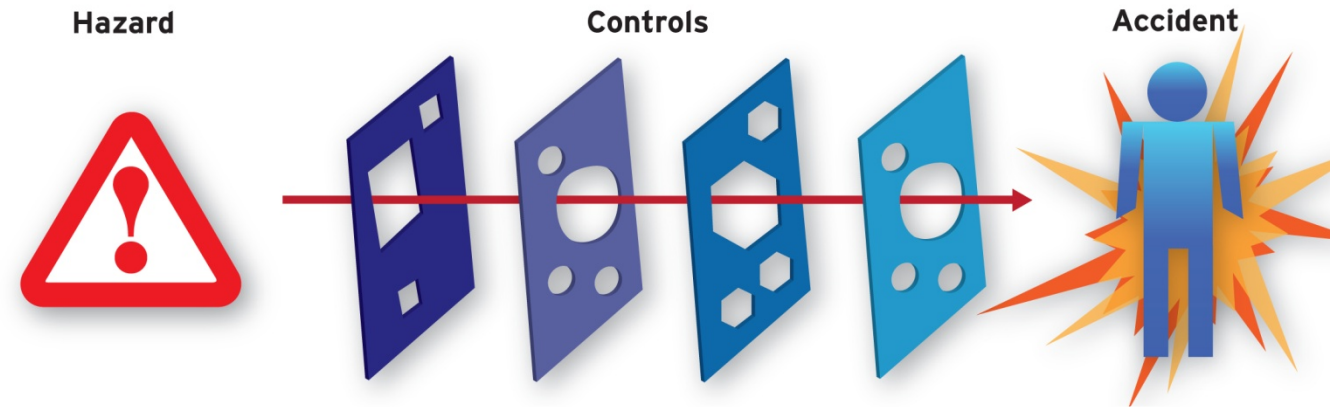
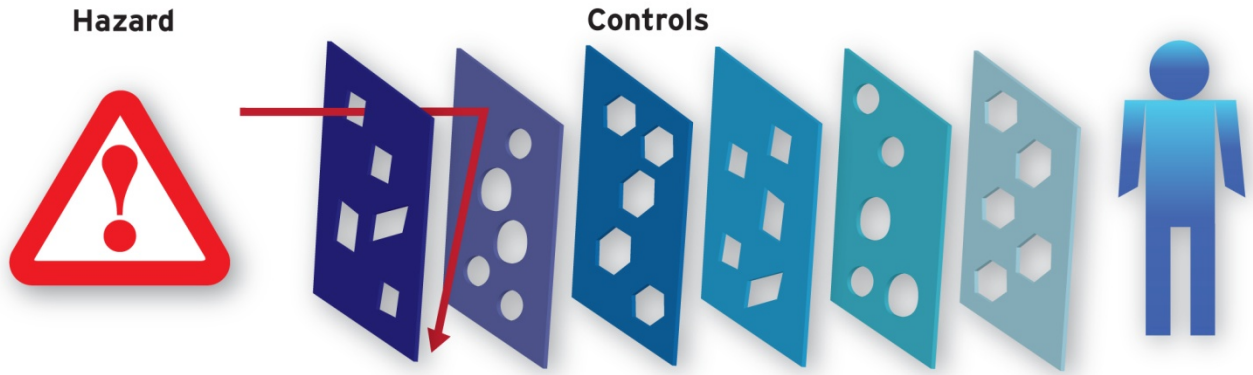


DIAGRAM 2



Adaption of James Reason's 'Swiss cheese' model

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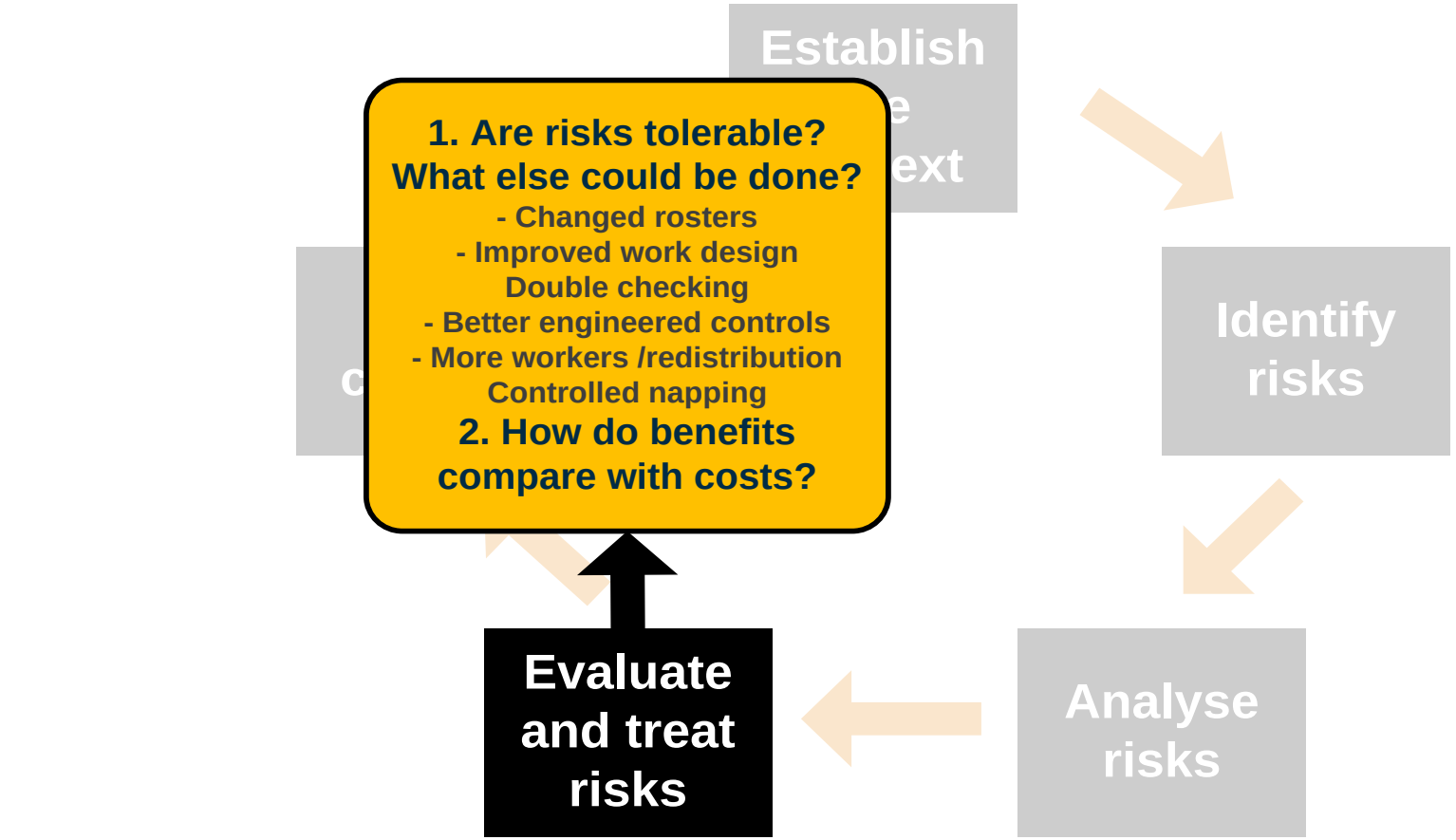
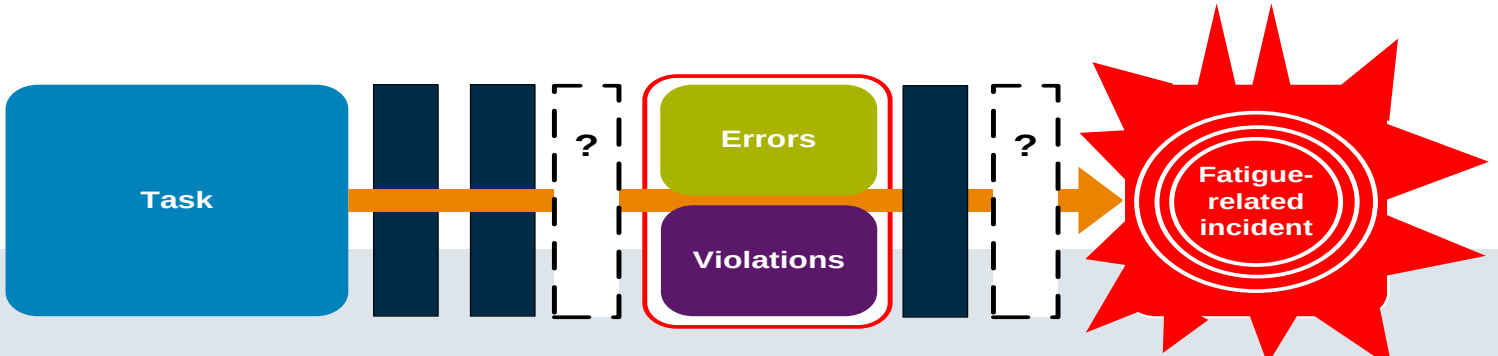
Fatigue risk management cycle





Fatigue risk management cycle

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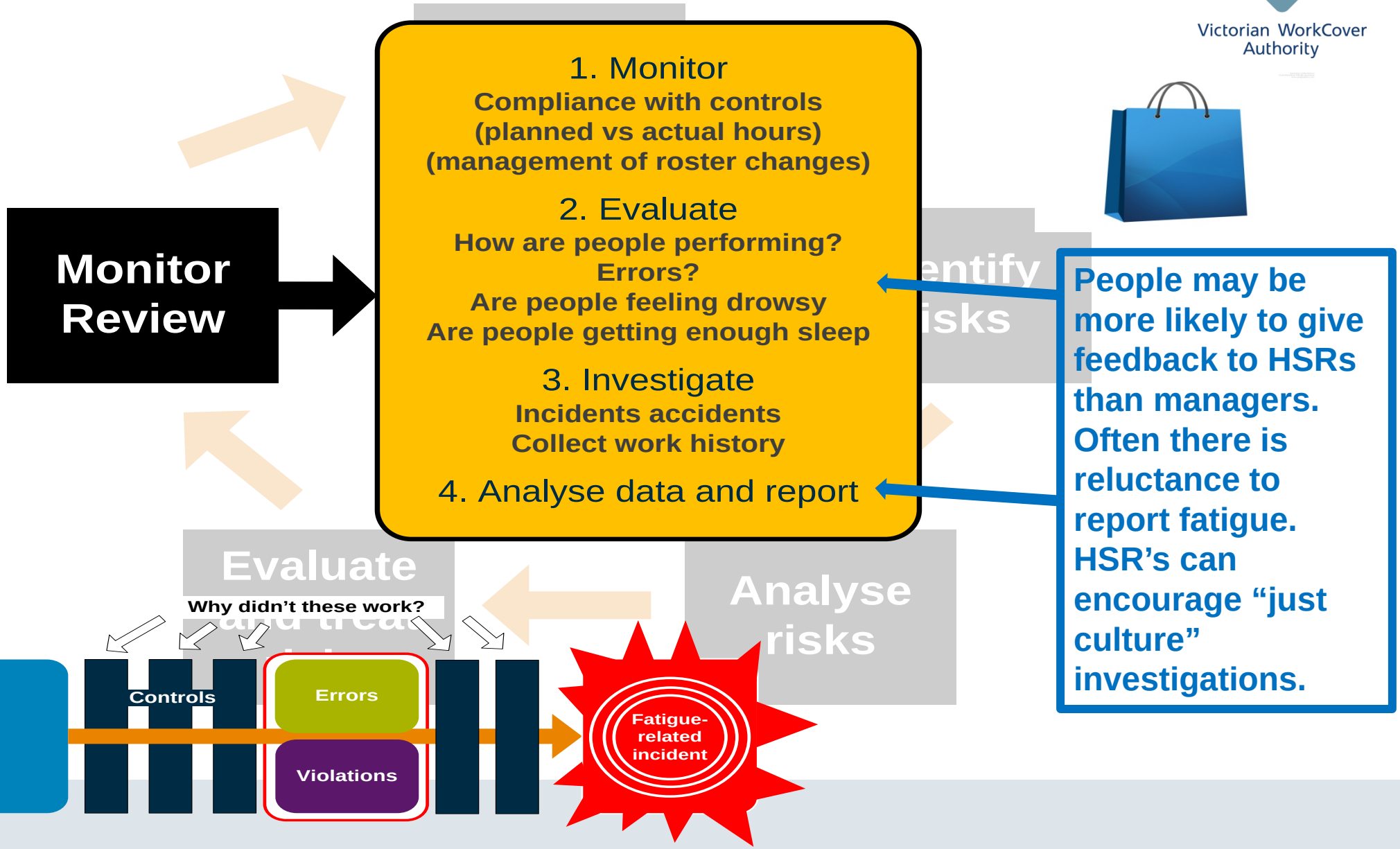

People may be more likely to give feedback to HSRs than managers. Often there is reluctance to report fatigue. HSR's can encourage "just culture" investigations.

Tools and models:
Have you optimised your layers of defence?

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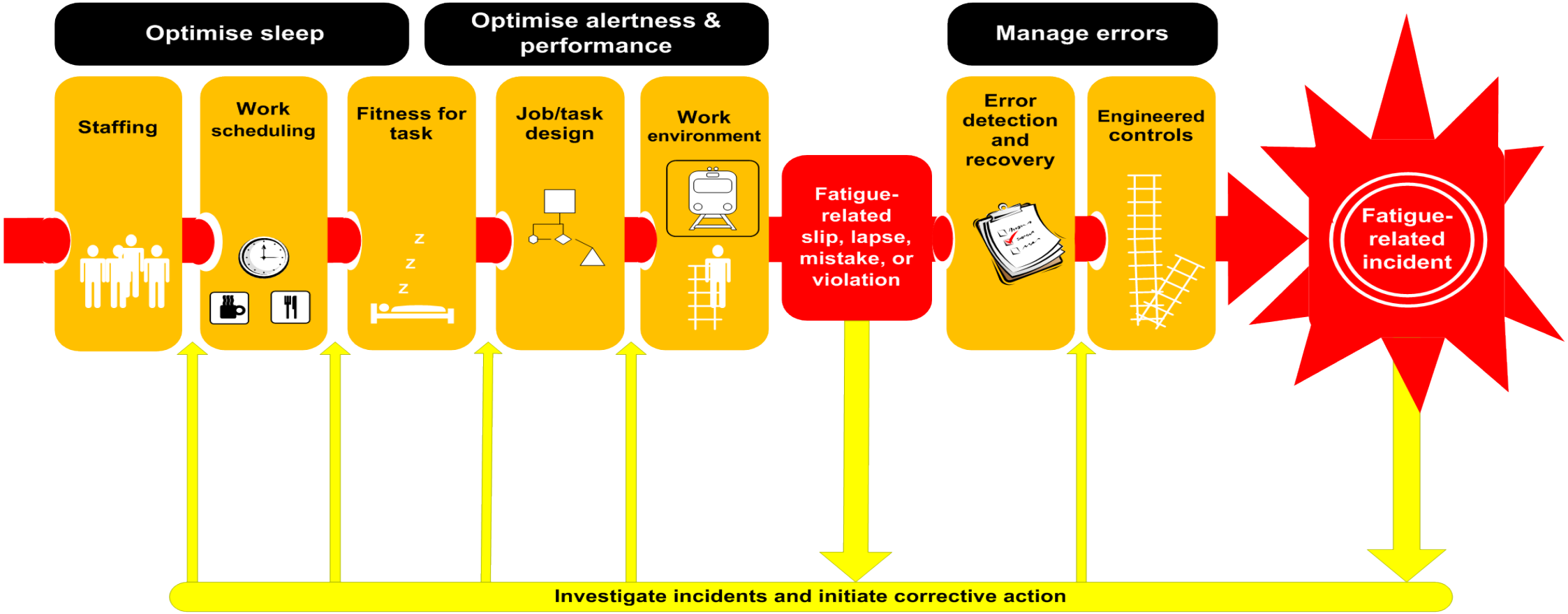

Developed by ONRSR based on Reason 1997, Dawson McCulloch 2003 and Moore Ede et al 2009

Are incident investigations looking for gaps in the system

Layer 1: Adequate skilled staff

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Staffing

- Workforce planning/ forecasting (leave, training, attrition)
- Workload monitoring
- Fatigue modelling
- Proactive recruitment
- Retention strategies
- Succession planning

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Layer 2: Scheduling of work to optimise sleep

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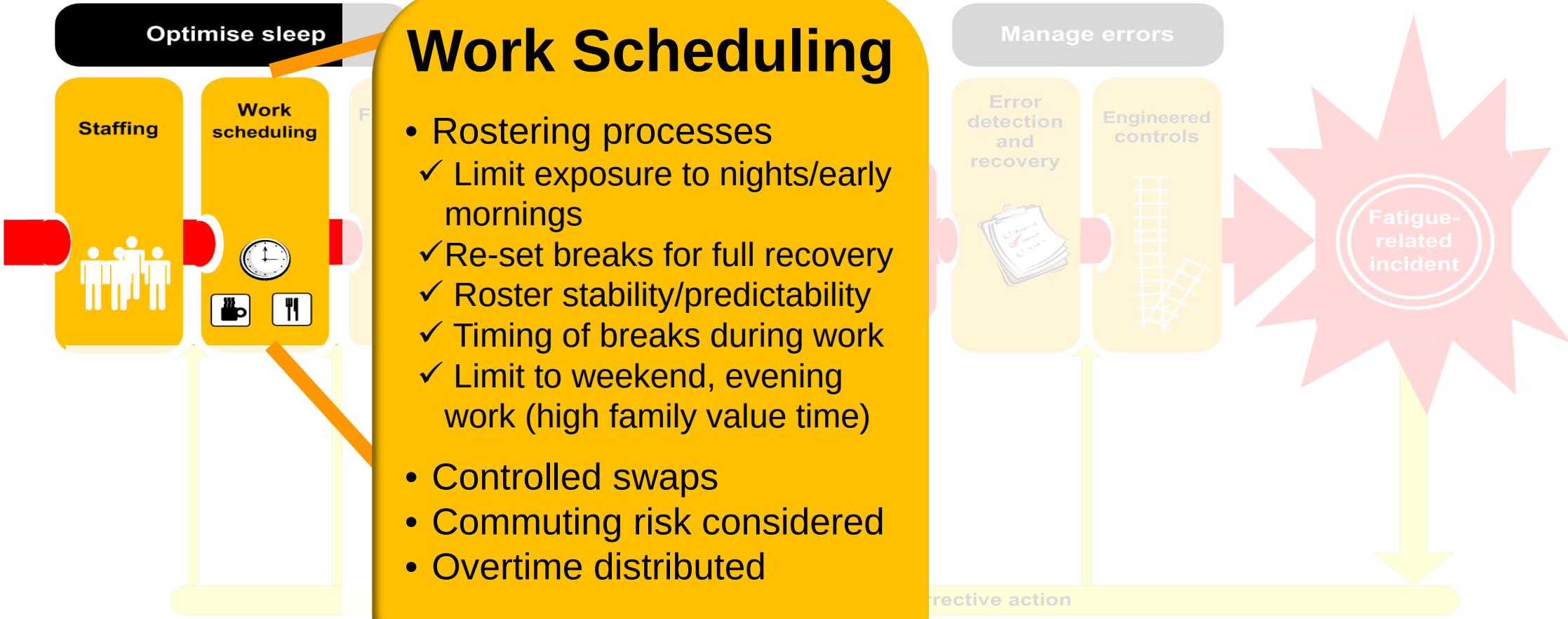

Work Scheduling

- Rostering processes
  - ✓ Limit exposure to nights/early mornings
  - ✓Re-set breaks for full recovery
  - ✓ Roster stability/predictability
  - ✓ Timing of breaks during work
  - ✓ Limit to weekend, evening work (high family value time)
- Controlled swaps
- Commuting risk considered
- Overtime distributed

*Layers of defence and accident trajectory ... cidents, Ashgate, Aldershot

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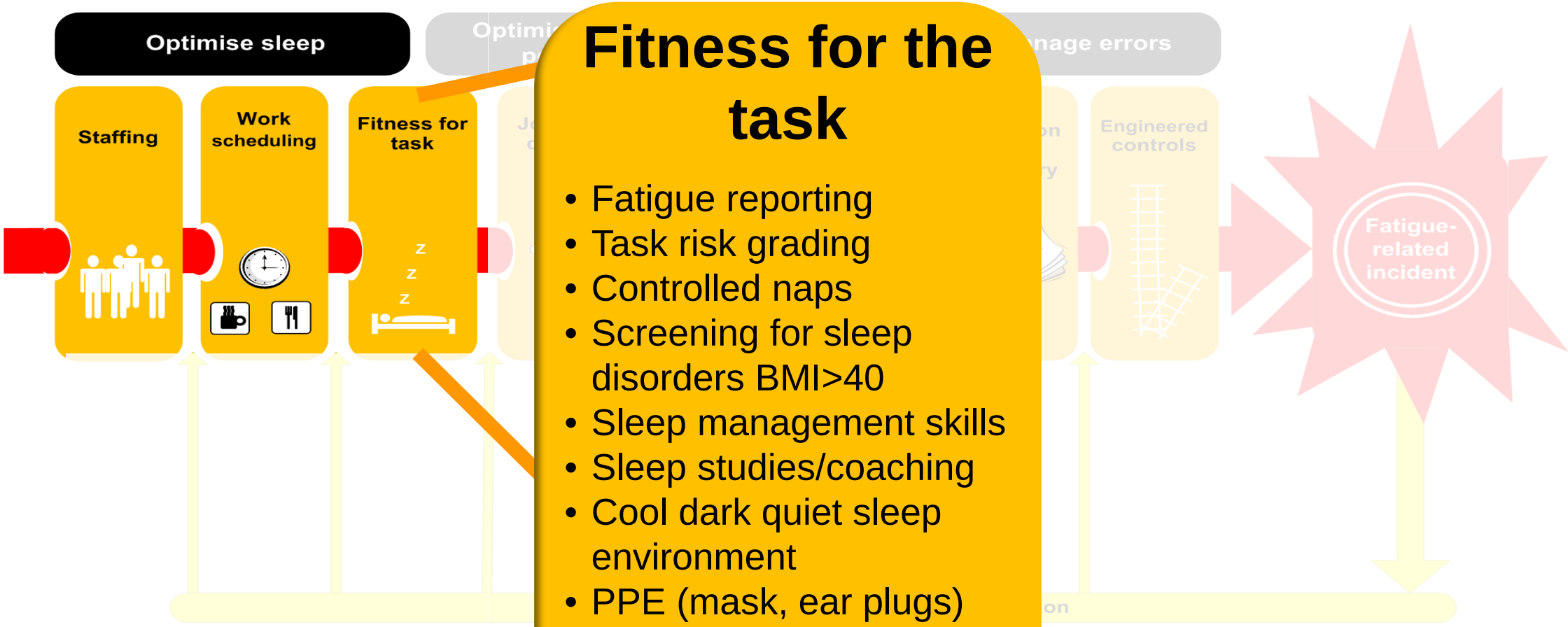
Layer 3: Fitness to do the task



Fitness for the task

- Fatigue reporting
- Task risk grading
- Controlled naps
- Screening for sleep disorders BMI>40
- Sleep management skills
- Sleep studies/coaching
- Cool dark quiet sleep environment
- PPE (mask, ear plugs)
- Strategic caffeine use

Layer 4: Job and task design to optimise alertness and performance

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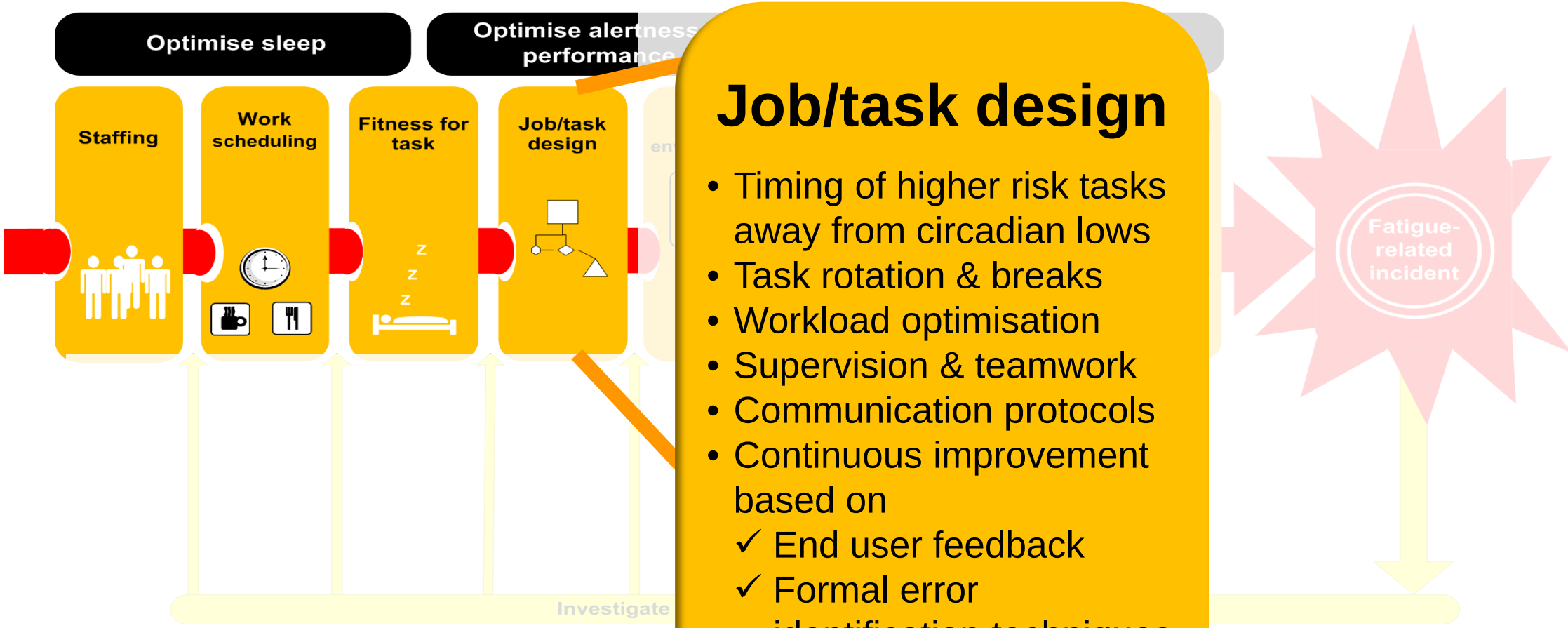

Job/task design

- Timing of higher risk tasks away from circadian lows
- Task rotation & breaks
- Workload optimisation
- Supervision & teamwork
- Communication protocols
- Continuous improvement based on
  - ✓ End user feedback
  - ✓ Formal error identification techniques

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Layer 5: Work environment to optimise alertness and performance

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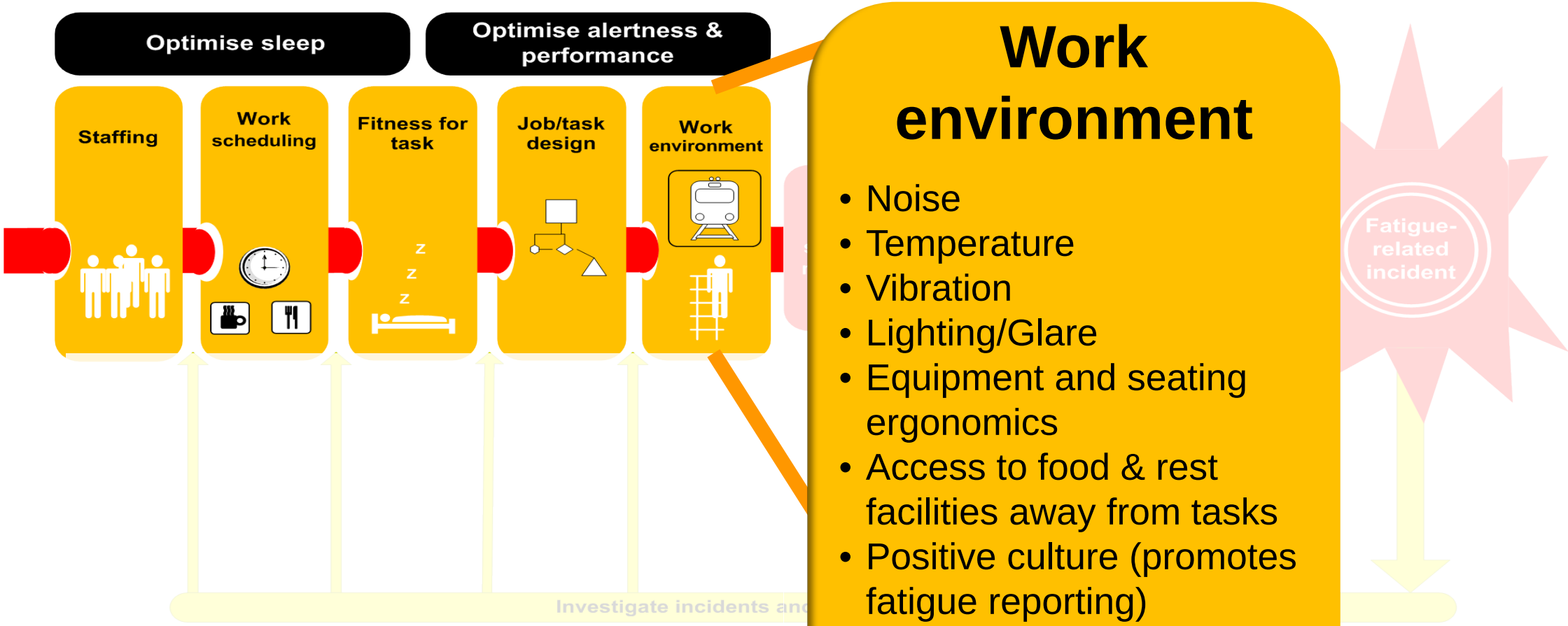

*Layers of defence and accident trajectory concepts based on Reason, J 1997. Managing the risks of org

Work environment

- Noise
- Temperature
- Vibration
- Lighting/Glare
- Equipment and seating ergonomics
- Access to food & rest facilities away from tasks
- Positive culture (promotes fatigue reporting)

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Layer 6: Work environment to optimise alertness and performance

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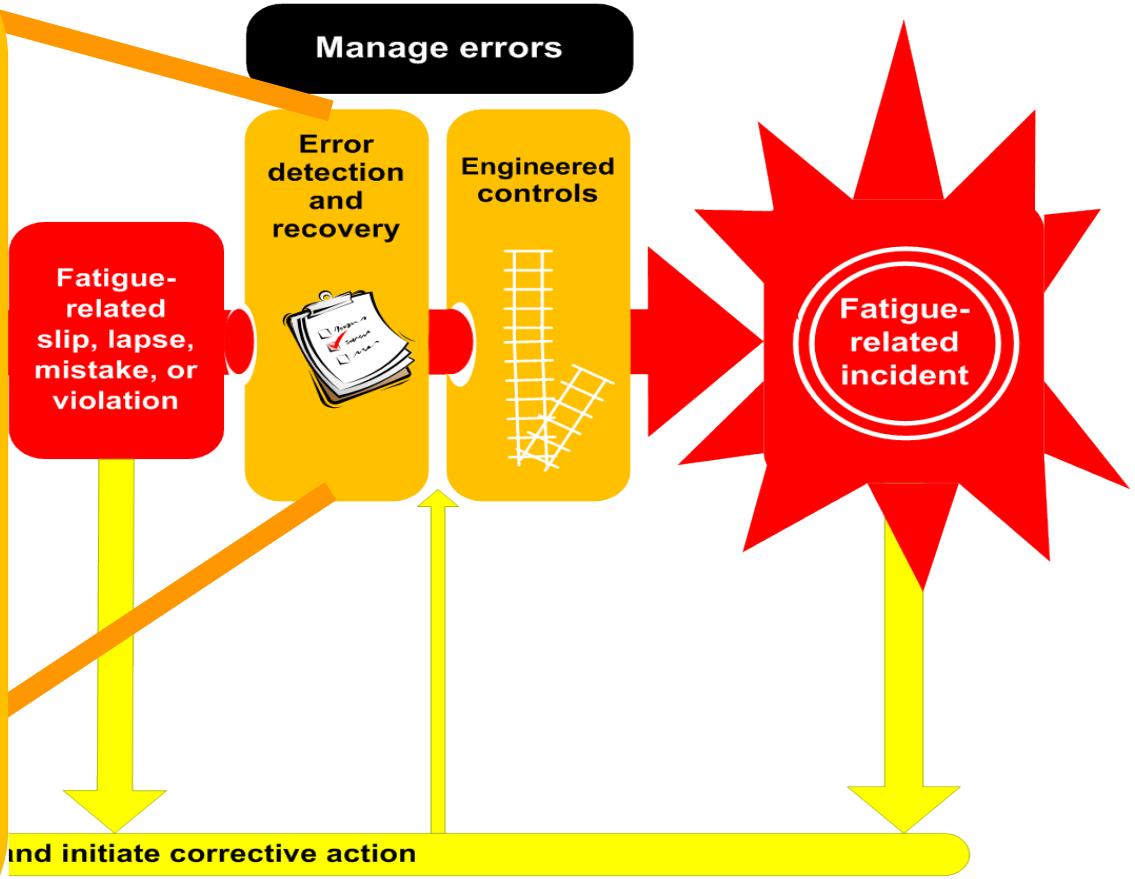
Error detection and recovery

- Alarms
- Software dialogue boxes eg “are you sure you want to ….?”
- Culture rewards error identification/reporting
- Cross checks
- Double checks
- Checklists
- Communication protocols
- Teamwork



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Layer 7: Engineered or technological systems

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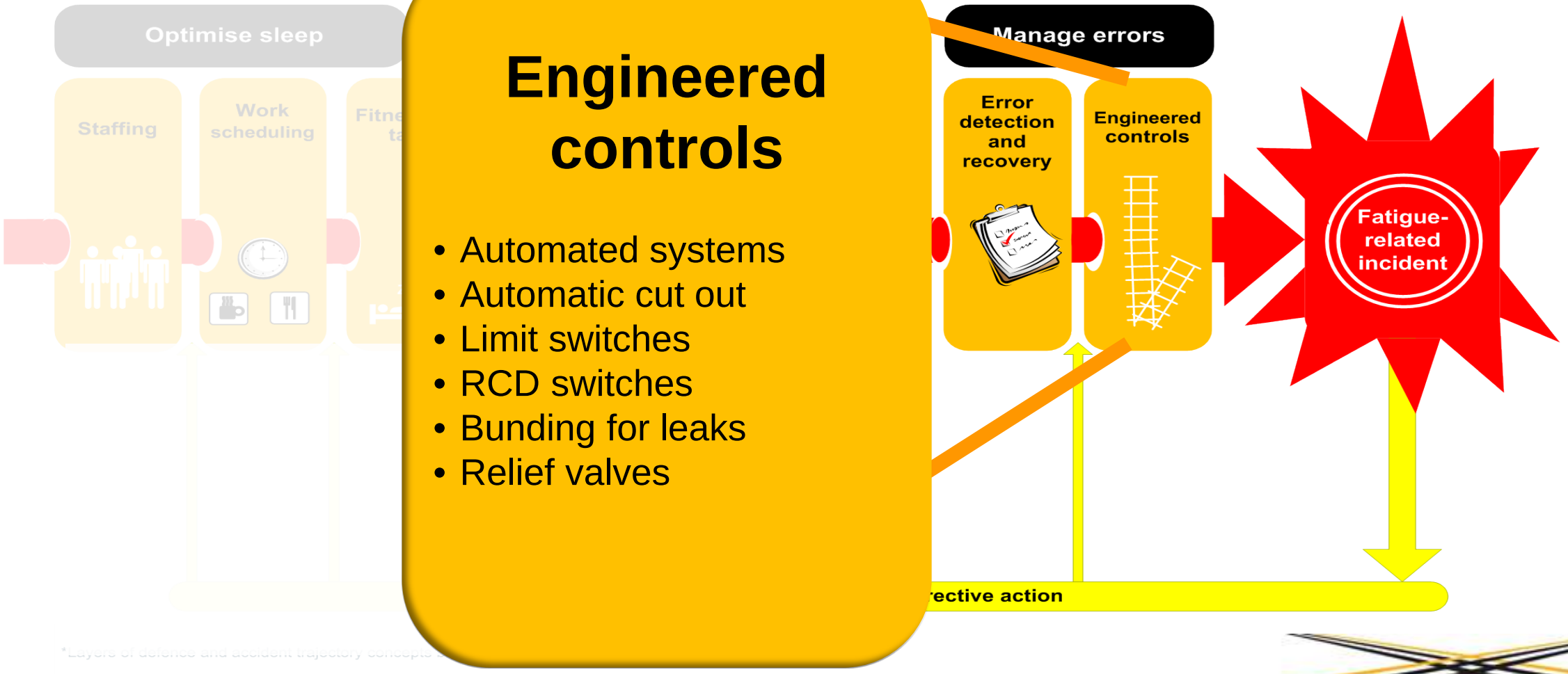

Engineered controls

- Automated systems
- Automatic cut out
- Limit switches
- RCD switches
- Bunding for leaks
- Relief valves

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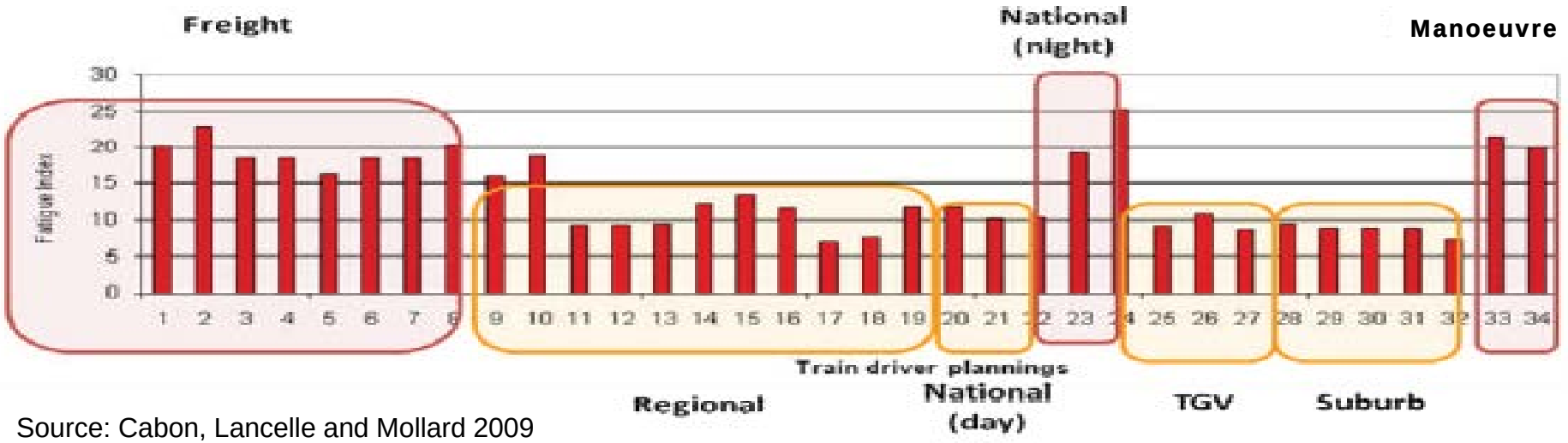
Tool: fatigue models

- Distribution of fatigue across business units
- Staffing imbalance
- Analyse roster options but not determine safe or unsafe
- Look for fatigue hotspots
- Not valid for individuals



Source: Cabon, Lancelle and Mollard 2009

Key points to take away

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Fatigue:

- Can be an insidious and latent hazard
- Often difficult for individuals to identify
- Amplifies other human factors
- Causes errors in dedicated, trained & experienced people and exposes vulnerabilities in systems and procedures
- Costly to individuals and organisations
- Can be effectively managed by informed people in a positive workplace culture

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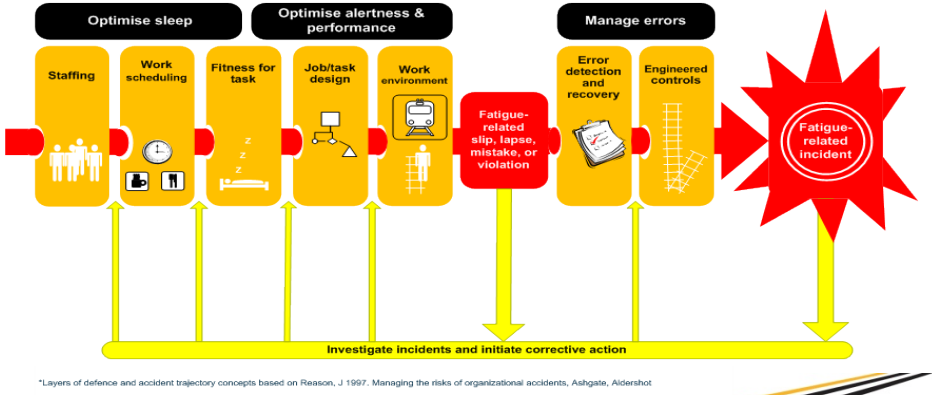
How HSRs can contribute

- Change agent for co-workers and managers to recognise and act on fatigue risks
- Ensure thorough consultation to identify hazards and risks (employer obligation)
- Identify options to improve defences:
  - Skills to better manage sleep and human error
  - Timing of shifts to improve sleep and alertness
  - Timing of production and safety critical tasks
  - Workload (team work, task rotation, breaks)
  - Workforce planning, resource distribution
  - Error tolerance of work systems and procedures



*Layers of defence and accident trajectory concepts based on Reason, J 1997. Managing the risks of organizational accidents, Ashgate, Aldershot

How HSRs can contribute

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- Post implementation reviews
- Troubleshoot issues outside regular review cycle
- Ensure post incident inspections look for fatigue factors if human error involved
- Promote ‘just culture’ reporting, investigation
- Advocate the enormous benefits to individuals and organisations (health, safety and productivity) of effective fatigue management

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Useful tools and resources

- Victorian WorkCover Authority fatigue handbook

http://www.vwa.vic.gov.au/__data/assets/pdf_file/0008/9197/vwa_fatigue_handbook.pdf

- Safe Work Australia fatigue guideline

http://www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/825/Managing-the-risk-of-fatigue.docx

- Harvard university guide to healthy sleep

http://healthysleep.med.harvard.edu/healthy/

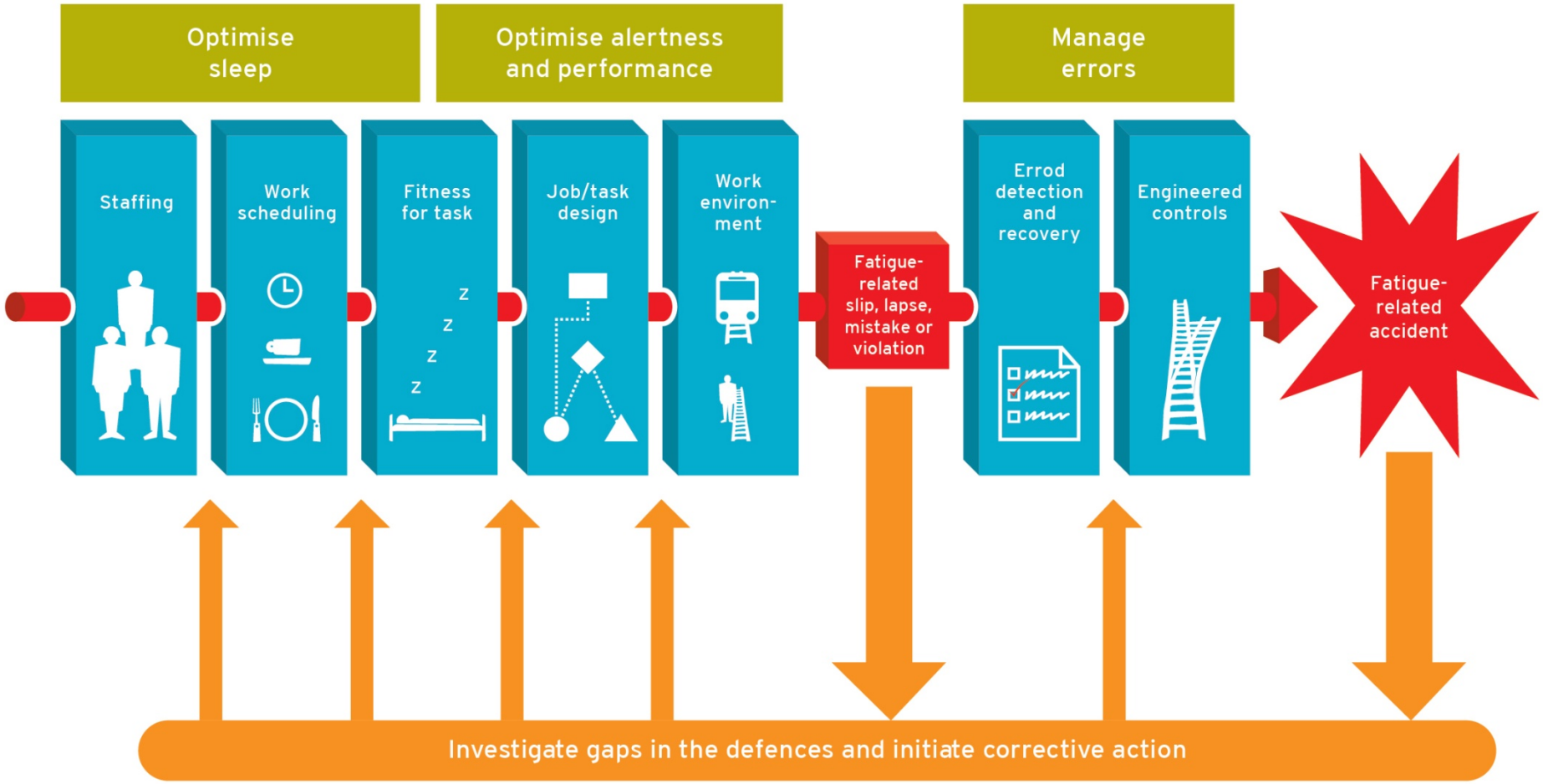
- UK Health and Safety Executive fatigue/risk index for shift workers

http://www.hse.gov.uk/research/rrhtm/rr446.htm

- Layers of defence model (Office of the National Rail Safety Regulator)

http://www.onrsr.com.au/__data/assets/image/0017/3086/Managing-fatigue-Fatigue-Risk-Management-7-August-2013.jpg

Fatigue risk management layers of defence



Developed by ONRSR based on Reason 1997, Dawson McCulloch 2003 and Moore Ede et al 2009

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Thank you for your attention

Questions?

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