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The Problem

The Pipeline and Hazardous Materials Safety Administration (PHMSA) of the United States Department of Transportation issued safety regulations in 2011 that required pipeline control rooms to implement methods "to reduce the risks associated with Controller fatigue that could inhibit a Controller's ability to carry out the roles and responsibilities the operator has defined."
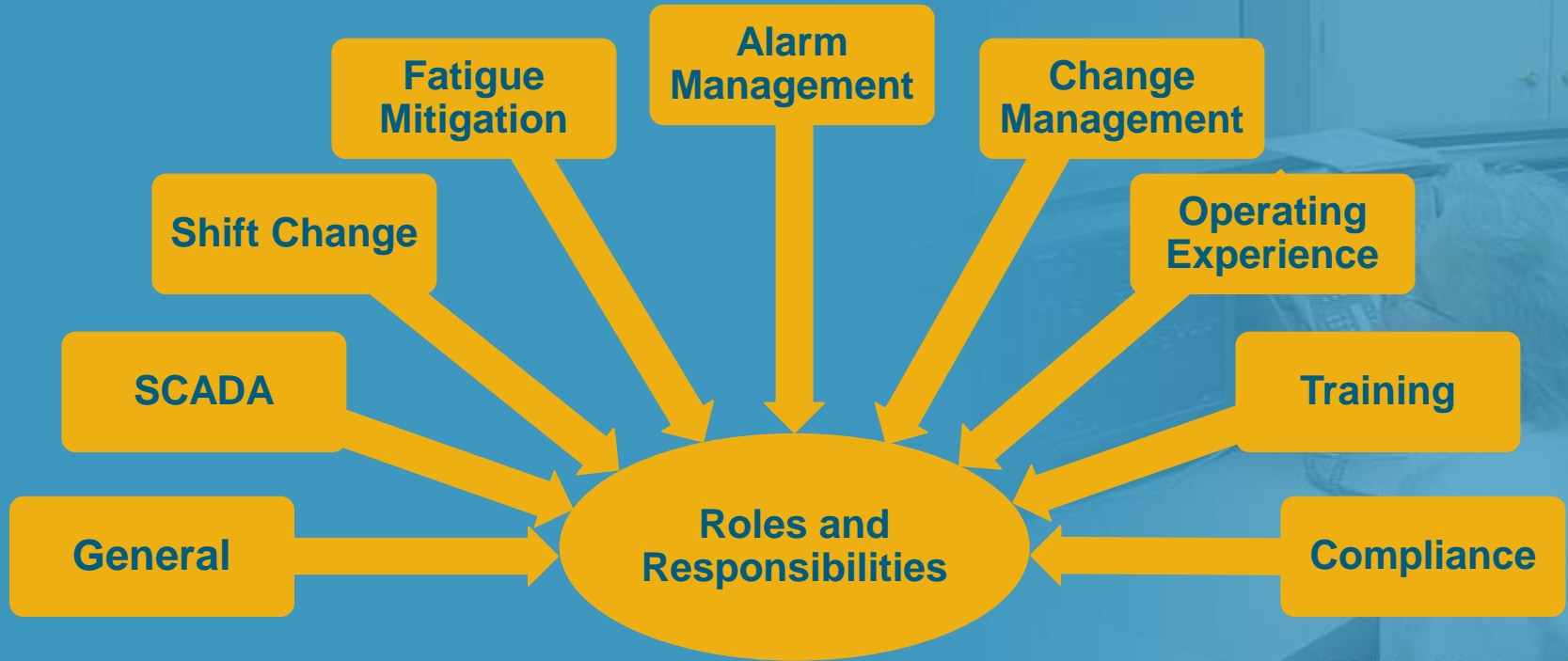
Regulatory Language

CFR § 192.631(d) and CFR § 195.446(d) Fatigue mitigation.

*Each operator must implement the following methods to **reduce the risk associated with Controller fatigue that could inhibit a Controller's ability to carry out the roles and responsibilities** the operator has defined:*

Regulatory Language

1. Establish shift lengths and schedule rotations that provide Controllers off-duty time sufficient to achieve eight hours of continuous sleep

2. Establish a maximum limit on Controller hours-of-service, which may provide for an emergency deviation from the maximum limit if necessary for the safe operation of a pipeline facility

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Regulatory Language

3. Educate Controllers and Shift Supervisors in fatigue mitigation strategies and how off-duty activities contribute to fatigue

4. Train Controllers and Shift Supervisors to recognize the effects of fatigue

That is Straightforward

Time Off

- Opportunity for Eight Hours of Sleep Between Shifts
- Limits on Hours of Service

Training and Education

- Fatigue Mitigation Strategies
- Effects of Off-Duty Activities
- How to Recognize Fatigue Effects

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What Else?

- FAQ D.09. PHMSA promotes the use of a fatigue risk management system (FRMS) as a tool for implementing fatigue mitigation
  - That is the extent of the initial guidance for a FRMS
  - PHMSA does have information on a website
  - Do most pipeline companies use a FRMS?
  - Do most pipeline companies know what a FRMS is?

Information and Tools

- Fatigue Modeling Software
- Fatigue Hazard Analysis Software
- Human Factors & Control Room Assessments
- Workload Assessments
- Information from Other Transportation Modes

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FRMS Statements – Reduce Risks

2.2   In addition to the four methods above, the intent of this plan is to provide additional countermeasures to reduce the risks associated with Controller fatigue.

2.3   Sleep-related factors, task-related factors, and activities during off-duty hours can contribute to Controller fatigue and to the risks of a fatigue-related pipeline accident or other event.

    2.3.1   The FRMS identified sleep-related and task-related fatigue factors and company specific fatigue risks through the hours of work diagnostic and the fatigue hazard analysis.

    2.3.2   The fatigue management training addresses how off-duty activities can contribute to fatigue and how personal choices and sleep disorders can reduce the amount of sleep necessary in order to perform job duties.

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FRMS Statements – Reduce Risks

6.2.2   The schedule and hours of work have been analyzed for potential fatigue risks using FAID® software that considers the effects of hours of work, amount of off duty time, circadian rhythm effects, and limits on recovery sleep.

6.2.3   A fatigue hazard analysis has been performed using HAZAID™ and GRAID™ that considers controller tasks, the environment, company practices, and requirements.   That analysis identified these Company-specific fatigue risks:

   6.2.3.1   A fatigue related occurrence driving to or from work
   6.2.3.2   A fatigue related occurrence at the beginning of shift change
   6.2.3.3   A fatigue related occurrence during shift change morning or night
   6.2.3.4   A fatigue related occurrence at the end of shift change
   6.2.3.5   A fatigue related occurrence during the first hour of shift (golden hour)
   6.2.3.6   A fatigue related occurrence during operational tasks at any time during the shift
   6.2.3.7   A fatigue related occurrence during an emergency response situation

6.2.4   The recommendations from that analysis have been incorporated into this plan to reduce the risks associated with Controller fatigue.

FRMS Document Components

- FRMS Responsibilities by Job Function
- Shift Length, Start and Start Times
- Schedule Rotations
- Staffing Analysis
- Commute Time Analysis

FRMS Document Components

- Fatigue Training
- Fatigue Education
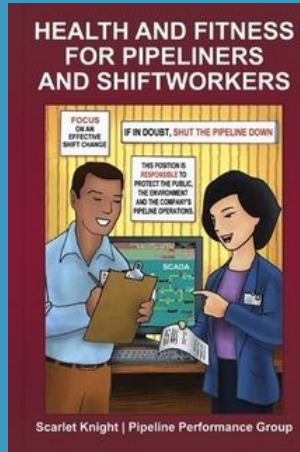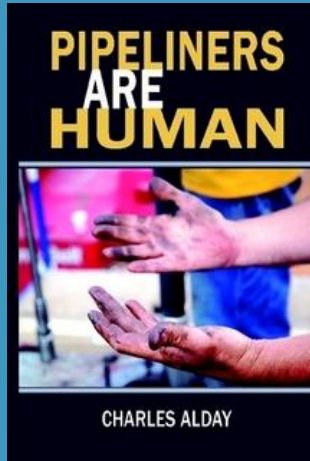
FRMS Document Components

- Environmental and Ergonomic Factors
- Fatigue Countermeasures during Shifts
  - Planned Breaks during Shifts
- Maximum Hours of Service (HOS)
- Emergency Deviations from HOS

FRMS Document Components

- Incident Investigation for Fatigue Related Factors
- Observations for Signs of Fatigue
- Fatigue Self Reporting
- Employee Issues that Affect Alertness
- Evaluation of FRMS and Fatigue Training

Summary

- There are several control rooms that could serve as case studies. The authors have worked with the people in these control rooms since 2008. PHMSA has conducted Control Room Management audits in these control rooms and found no deficiencies in the fatigue mitigation regulatory requirements or the workload assessment requirements.

Summary

- Controllers have made positive changes in their personal fatigue management practices
  - Using off duty time between shifts to sleep
  - Getting regular health checkups including sleep studies
  - Applying what they have learned about the dangers of drowsy driving to change behaviors
  - Using less caffeine as a fatigue countermeasure
  - Getting more regular exercise
  - Eating more healthful foods

Conclusion

- Satisfying the regulations is not difficult
- Implementing and maintaining a FRMS is difficult

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