

Human Factors And Pipeline Safety: PHMSA Proposed Rule



By **Charles Alday** and
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Why don't you pipeline companies address controller fatigue?" The board member of the National Transportation Safety Board asked that question in the year 2000 while discussing a pipeline accident with one of the authors. "Reduce Accidents and Incidents Caused by Human Fatigue" is on the "NTSB Most Wanted List."

The PIPES Act of 2006 indicates that regulations shall be issued that require operators of gas and hazardous liquid pipelines to evaluate and take measures to reduce risks associated with Human Factors, including fatigue, for pipeline controllers and other employees. The "Pipeline Safety: Control Room Management/ Human Factors: Proposed Rule" was issued by PHMSA on Sept. 12, 2008.

What is Human Factors? What measures can be taken to reduce the risks of Human Factors? What does the proposed rule include that addresses Human Factors? The industry has addressed some of the issues through Operator Qualification, but the proposed rule outlines others.

Human Factors applies the knowledge of human capabilities and limitations to the design, operation, and maintenance of a system. When Human Factors Engineering is integrated into all aspects of a pipeline system, the risks of accidents from human error can be reduced. The public, the employees, and



Figure 1: Key Aspects of Human Factors

the environment are safer. The company has a more efficient and effective operation.

Human Factors examines the interaction between people and all of the factors around them — the environment, the procedures, equipment, and other people. The discipline of Human Factors looks at people, the job, the organization, the environment, and our resources. The goal is to improve the interactions.

The "tight coupling" of a pipeline system makes it vulnerable to an unexpected event or series of events. This is one of the reasons the proposed rule includes sections on SCADA displays, communications, management of changes, alarm management, shift exchange, learning from experiences, qualifications, roles and responsibilities, validation, as well as fatigue mitigation.

An accident usually has multiple causes, and a failure in one area can lead to a failure

in another area. Organizations, jobs and individuals may function independently, but all the functions are connected and interdependent. The key aspects of human factors are related to the individual, the organization, and the specific job (see Figure 1).

Humans have certain capabilities and limitations for physical functions such as vision and hearing, but also for social, emotional, and cognitive performance (see Figure 2). Each person in a company has physical, mental, intellectual and psychological strengths and weaknesses. Issues in personal lives and health also affect performance. Some of these factors are straightforward and easily measured while others are difficult to measure or unpredictable.

The proposed rule contains requirements for addressing the capabilities and limitations. For example, fatigue is an issue that affects all humans. That fact needs to be addressed through an evaluation of the shift

work policies and practices, ongoing education, the responsibilities of the employee and the company, and communication during shift exchange, and in other ways. Ensuring that human capabilities and limits are not exceeded promotes a safe level of operations.

**Who is doing it?
What might cause problems?**



Figure 2: Individual Factors

The leadership, organizational structure, and culture are factors that can either prevent or cause problems (see figure 3). The proposed rule requires a company to address changes, evaluate and learn from operations, and validate that Human Factors are well-managed. A learning organization has a process for review of all safety incidents and near misses. It develops solutions rather than casting blame.

A strong leadership emphasizes the importance of public safety and maintains constant involvement in operations. The organization manages changes that affect operations, ensuring that every affected person has the necessary information about the changes. Regular and accurate communications between management and personnel ensures that information flows effectively. Employees become more engaged and personnel feel that they make a positive contribution.

**Where are they working?
What might cause problems?**



Figure 3: Organizational Factors

Well-designed jobs support the capabilities and limitations of the different people that fill those positions (see Figure 4). It is not possible to “plug and play” a person like a computer module. Supporting personnel means providing equipment that does not tax the physical capabilities of the human operator. User interfaces are designed to clearly and consistently present information in a manner allows for fast and accurate information retrieval under normal and emergency conditions.

Working conditions should be pleasant, clean, and free from distractions, excess noise and over-stimulation. The proposed rule seeks to ensure that the responsibilities of the job are well-defined, that people have the necessary instructions and training, and that SCADA displays and alarms are useful tools instead of hindrances to safe performance.

Figure 4: Job Factors

**Where are people being asked to do and where?
What might cause problems?**



PHMSA and the pipeline industry are working together on the proposed rule. API issued a recommended practice concerning control room management about the same time as the proposed rule was issued by PHMSA. Comments on the proposed rule have been received and are being addressed. The final rule will be different, but the pipeline companies will still be required to address Human Factors, particularly human fatigue and the other areas in the proposed rule. *P&GJ*

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