

# High Reliability Management in Process Industries: Sustained by Human Factors

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*“By failing to prepare, you are preparing to fail.”*

- Benjamin Franklin

## Introduction

It has been almost four years since the Safety and Environmental Management Systems (SEMS) regulations were promulgated and on November 15, 2014, it will be one year since the end of the first SEMS Audit Cycle. According to the Bureau of Safety and Environmental Enforcement (BSEE) 86 percentage of the regulated operators successfully demonstrated that they met required SEMS program requirements. Moreover, in August 2014 only three operators were still out of compliance.<sup>i</sup>

One of the intents of SEMS is to focus attention and resources on human behavior and its impact on processes as well as organizational structural changes and leadership to develop a Culture of Safety (COS) with a focus on sustained improvements.<sup>ii</sup> From a 2013 study regarding SEMS implementation in the industry, it is clear that organizations are integrating the SEMS requirements into their Standard Operating Procedures (SOPs) or Operations Management Systems (OMS).<sup>iii</sup> This is a logical step because the OMS is the field manual for the organization and its suppliers and partners.

Moreover, as part of this process, many in the industry have been looking at other critical industry sectors for good or perhaps even best practices. Sectors of interest include nuclear, military, medicine, power generation and distribution, and others. Those where very high levels of reliability are critical and failure is truly not an option as the ramifications of even a small failure can have far reaching consequences.

The recent Ebola virus case in Dallas, Texas is one example. Apparently, a small mistake during the patient admittance workflow process has triggered a multi-million dollar response whose outcome is still unfolding.<sup>iv</sup>

Normal Accident Theory (NAT) suggests that highly complex, interactive, and tightly coupled systems will inevitably have accidents. In other words, this is the normal course of events in a modern technologically driven world.<sup>v</sup> However, one can argue that as in the Dallas Ebola case, accepting inevitability should not be standard operating procedure.

## **Behavioral Economics**

Physical (the universe for example) and human processes all have structure. Almost twenty years ago, the construct of Structural Dynamics was developed. Structural Dynamics is defined as “the morphology or patterns of motion towards process equilibrium of interpersonal systems.”<sup>vi</sup> The physical Laws of Thermodynamics describe the very nature of energy and dictate how systems interact with each other.<sup>vii</sup> Structural Dynamics is the counterpart for human systems.

*Behavioral Economics* is often defined as a study of market behavior. That definition is extended through the Structural Dynamics model to encompass organizational governance models that are manifest in Operations Management Systems. Briefly, governance enables owners to oversee the performance of professional management and has its roots in Agency Theory.<sup>viii</sup> In other words, governance is all about behavioral economics.<sup>ix</sup>

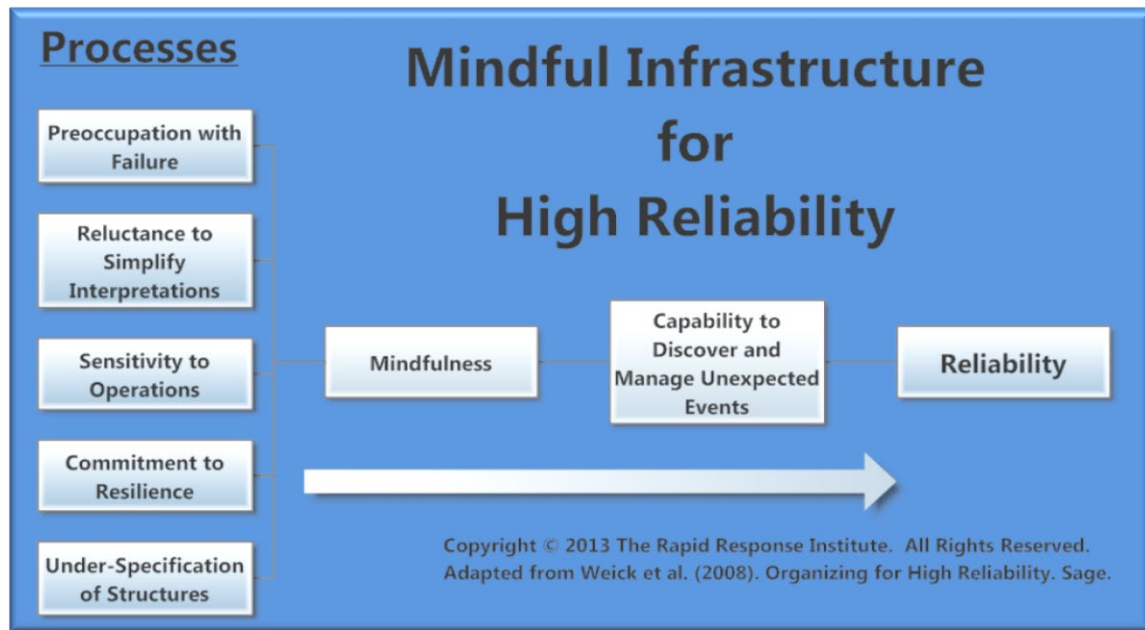
## **Enter High Reliability Management**

Reliability is the ability to maintain performance during complexity, uncertainty, and the unexpected. Reliability is:

- Managing Complexity
- Decision-Making
- Managing Errors
- Learning
- Managing the Unexpected<sup>x</sup>

Virtually all modern organizations have exposure to risks that threaten to their ongoing viability. The agility and resilience of an organization can dictate whether it is one that accepts the fate of NAT or rapidly responds to incidents and minimizes their impact.

High Reliability Management is a mindset of focus on organizational decision support infrastructure. As shown in the following graphic.<sup>xi</sup>



If one looks at the five processes on the left side of the figure, the first four are focused on human insight and decision-making. The fifth, *Under-Specification of Structures* suggests a level of informality or collaborative organizational structure as opposed to the often, hierarchal model.

These five human-focused factors enable a mindfulness or mental state of consciousness. Only humans are capable of discovering and making the hard decisions necessary to manage unexpected events such as the Ebola virus in Dallas. This human agility and resilience capability is the fundamental driver of reliability.

## Human Factors Engineering

Human factors engineering (HFE) has proven “value-added” merit when applied systematically top-down, starting with requirements definition in the concept and select phases with defined strategies through operations to decommissioning.<sup>xii</sup> Timely and appropriate integration of human factors into capital projects with full commitment of management yields all the desired advantages that are often elusive in capital projects. This discussion focuses on the role of human factors in the domain of highly reliable management and risk containment.

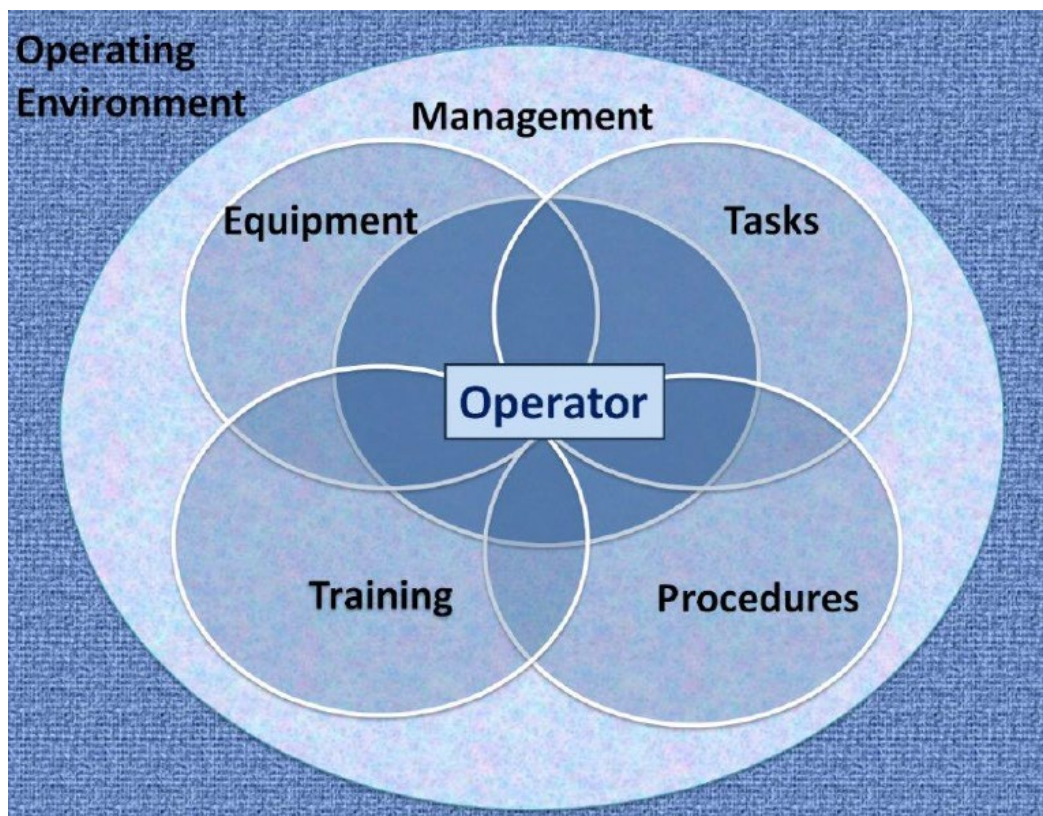
### Concept of Human Factors

The concept of human factors engineering to some seems extraordinarily and unnecessarily elusive. However, the breadth and scope of the scientific discipline is extremely encompassing. If one contemplates that anytime there is a human in the system, human factors should be considered – the enormity is all encompassing.

The integration of human factors into capital projects is not a new concept. In fact, it has been successfully and apparently quietly applied for decades.

Often its application to capital projects was driven by regulatory impetus. After a time, those entities became accustomed to considering human factors and soon realized the benefits. Thus, human factors became a way of doing business, unquestioned, and readily accepted as much as any other program geared toward design, development, use, operations or maintenance of any system.

HFE places the human operator at the center of the complex operating environment. HFE recognizes that this individual or set of individuals is the puppet master and is responsible for the entire show.



System designers in highly reliable organizations address attention explicitly to human factors. One main reason is that a skilled designer knows that a better working environment can reduce an operator's stress, which in turn substantially increases the operator's performance and effectiveness for handling abnormal situations, as well as reduces health issues and turnover of resources.<sup>xiii</sup>

## Human Error

According to Lifetime Reliability Solutions, “human error in anticipating failure continues to be the single most important factor in keeping the reliability of engineering designs from achieving the theoretically high levels made possible by modern methods of analysis and materials. ...nine out of ten recent failures (in dams) occurred not because of inadequacies in the state of the art, but because of oversights that could and should have been avoided.” Lifetime Reliability maintains that poor reliability, poor maintenance, poor production and performance are under the auspices of management, the designers and managers of business processes who run and maintain system processes.

## Path to High Reliability

Macroergonomics is the sub-discipline of ergonomics that focuses on the design of the overall work system. Conceptually, a top-down sociotechnical systems approach to the design of work systems and carry through of the overall work system design characteristics to the design of human-job, human-machine, and human-software interfaces to ensure that the entire work system is fully harmonized. The top-down, macroergonomic approach--systemizing functions, i.e., standardization and consistency across the organization (within and among plants) parallels the classic system engineering approach.

*"If you take a microergonomic approach and look at the research results over the years, successful programs tend to get a 10-25 percent improvement, whether it is in productivity or accident reduction."<sup>xiv</sup>*

*But, when you get the macroergonomic level in there a 50-90 percent improvement is seen. Associated benefits include better productivity and quality, and improved job satisfaction and employee commitment."<sup>xv</sup>*

## Power of Intuition

Intuition is the way experience is translated into action.<sup>xvi</sup> It is how people make good decisions without performing deliberate analysis.

Intuition is the natural extension of experience and preparation. It is “acting without apparent consideration.”

It is illustrated by those senior people (such as firefighters) who jump into action and solve a problem without conscious or apparent deliberation. In their minds, there is only one course of action. And, it is the correct action.

Albert Einstein said, “The intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created society that honors the servant and has forgotten the gift.”

The experienced leader, decision maker, or that person who determines a course of action relies on subtle cues without conscious awareness. These trustworthy judgments rely on informed skilled intuitive decisions as well as analytical strategies. Intuition and analysis are both necessary.

In an era of increasing complexity, new technology, remote operations, and automated functions, it is that leader who intuitively controls, contains, and resolves mishaps and incidents that avoid or mitigate the effects of missteps. In contemporary consideration of the role of the human in high reliability systems, this competency among decision-makers is an imperative.

### **Locomotive Momentum**

Oddly enough, the laws of physics apply to organizations as well as the momentum of the universe. There are well-known organizations that have failed or nearly faced demise when these laws are violated or ignored.

In retrospect, there are always the Monday quarterbacks who proclaim that they could have (or should have) predicted the events that transpired. Perhaps no one could predict how the public would embrace computing or social media.

Remember the president of IBM, who firmly believed no one would want a home computer. Consider the obsolescence of those items that at one time were leading edge (rotary phones, Polaroid cameras, mimeograph and facsimile machines for starters).

When an organization is very large, it has momentum due to size, similar to a locomotive. The perils of derailment may be readily apparent; however, without highly reliable management that organization may not have the tools to prevent failure.

It is hard to stop a train (to paraphrase a well-known commercial). The momentum afforded by physics and the laws of science, often give a false impression of well-being.

Variables like lack of communication, intolerance of change, “being an ostrich” – ignoring trends, and taking success for granted can accelerate what inevitably becomes failure. There is false security in the momentum achieved but ultimately not sustained by management that are not highly reliable or those who did not embrace the proven tools at their disposal.

***Forward motion is not always progress. The path to sustained success is not always linear.  
Forward motion is not always a good thing.***

What if moving forward means falling off a cliff or crashing into the car in front? Before moving forward is celebrated, the destination must be diligently scrutinized.

Harvard Business Review states, “It’s tough when markets change and your people within the company don’t.”<sup>xvii</sup> Because a strategy or method worked in the past, that does not mean it is viable for the highly reliable organization of today, needless to say, tomorrow.

On occasion, engineering may have become synonymous with “cut-and-paste.” However, this may have a drawback. Adherence to the last war; “generals fight the last war” is often fraught with risk and can lead to disaster. Beware of cut and paste without proper assurance of its relevancy to the new problem.

## **Action Plan**

The High Reliability Management business model is beginning to find acceptance with the upstream oil and gas industry and its supply chain partners. Human Factors Engineering is a major component of the Mindfulness of High Reliability Management.

All decision making is human-based regardless of the outcome. Moreover, engineering processes are almost by definition a set of human decisions.

SEMS was the first step in the journey towards a high reliability global oil & gas industry. As the industry advances up the Culture of Safety Maturity Model,<sup>xviii</sup> the incorporation of behavioral economics and human factors engineering may result in meeting safety targets the industry established through the Center for Offshore Safety in 2011.<sup>xix</sup>

## **About the Authors**

### **Denise M. Brooks, Ph.D.**

Dr. Brooks is a solutions-driven human factors specialist with expert knowledge in solving workplace problems. She has a unique ability to identify underperforming areas in diverse environments and immediately deploy corrective action plans to ensure regulatory compliance, maximize employee performance, and improve safety/ergonomics. She works with all levels in an organization to resolve issues; drives strategic decision-making processes. She is experienced in multiple job market sectors including manufacturing, government agencies, oil and gas, nuclear power generation, and environmental restoration and remediation.

### **Scott M. Shemwell, D.B.A.**

Dr. Shemwell has over 30 years technical and executive management experience primarily in the energy sector. He is the author of four books and has written extensively about the field of operations management. Shemwell is the Managing Director of The Rapid Response Institute, a firm that focuses on providing its customers with solutions enabling operations excellence and regulatory compliance management.

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