

# NEW FINDINGS ON SERIOUS INJURIES AND FATALITIES

*Validating a new paradigm to inform prevention initiatives*

## Situation and Study Overview

Over the past five years a startling data pattern has emerged in which the rate of recordable injuries has declined, but the rate of serious injuries and fatalities (SIFs) is either flat or increasing. The pattern is seen to varying degrees at the site level as well as at the company and national levels, and calls into question fundamental long-standing safety science assumptions.

BST clients expressed concern and asked us for insight that would inform a model for preventing serious injuries and fatalities. Seven global companies (ExxonMobil, PotashCorp, Shell, BHP Billiton, Cargill, Archer Daniels Midland Company, and Maersk) sponsored an initial study to refine and validate a New Paradigm for Serious Injuries and Fatalities to inform the design of a prevention initiative model. Six of the seven companies contributed extensive data which was combined and subjected to in-depth qualitative, quantitative, and root cause analysis. Leaders from each company formed a team to support the analysis and interpretation of data and give shape to the design of intervention strategies.

The study surfaced two primary reasons that a reduction in less serious injuries does not necessarily correspond to a proportionate reduction in SIFs:

1. The causes and correlates of SIFs are often different than those of less serious injuries, and
2. The potential for serious injury is low for the majority (about 80%) of non-SIF injuries.

The study further finds that SIFs have identifiable precursors, most frequently associated with basic safety systems integrity and conformance. However, the impact of precursors is not fully apparent unless enough incidents are studied longitudinally (over time), which is not commonly undertaken. Our experience has shown that most organizations are not aware of the importance of conducting this type of analysis.

In the U.S., the OSHA system for classifying and recording injuries has been an important driver of safety improvement. However, the system does not distinguish those injuries with potential for SIFs from those without. As a result, organizations that rely exclusively on, and are in total compliance with, OSHA and industry recordkeeping standards, may have experienced a high number of injuries with the potential to be far more serious or even fatal and not be cognizant of this fact. Unaddressed, these types of injuries can become eventual fatalities.

Intervention criteria, principles, and methods have been developed based on the findings of the study. In order to apply these findings optimally, it is recommended that each organization first study its own data and find relevant precursors, make them visible, and then ensure that safety systems address them.

Designing interventions to prevent SIFs (an outline is provided in this paper) should be undertaken as an organizational change process led by senior management. These interventions should engage employees at all levels, put sustainable mechanisms in place, and measure safety culture, leadership and outcome results on an ongoing basis.

## The Compelling Case for Studying SIFs

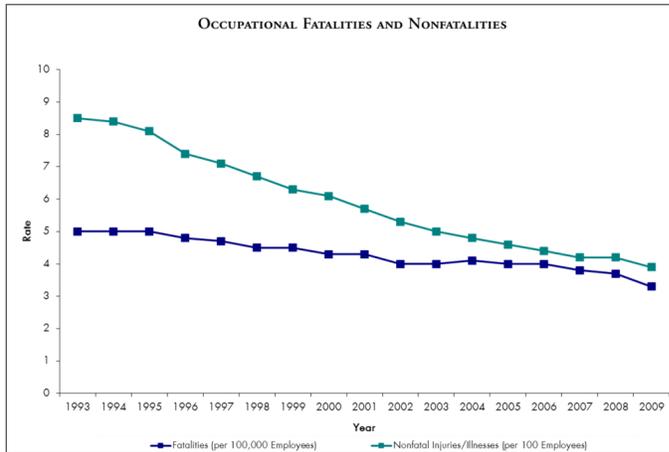
### Consider this Scenario

Safety leaders at the site were feeling good. Recordable injuries had decreased, beating their goal for the year. Their Total Recordable Incident Rate was better than most other facilities in the division, and Lost Time Incident Rates were low as well. The corporate group planned a congratulatory visit to the location and a celebration was in the making.

Within the next two months the location experienced a fatality and two very serious, life altering injuries.

Safety leaders were perplexed by this situation. They did not understand how the sequence described above could happen, given what they knew from their safety performance data. Some thought it was bad luck. Others thought they had “taken their eye off the ball,” But how? No one could give a coherent account of the situation.

Figure 1

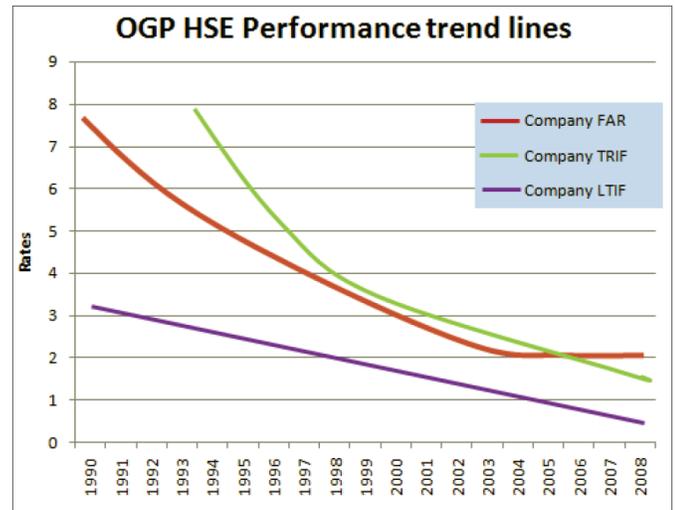


Leaders who follow safety closely have seen this scenario unfold before and they know it points to something. It doesn't make sense to see excellent results in the primary safety metrics the organization tracks and see dramatically different results with serious injuries and fatalities.

But as we've noted, the fact is that national data in the U.S. over the past ten years shows recordable incident rates have steadily declined, while fatality rates have stayed essentially level (United States Department of Labor, Bureau of Labor Statistics, 2011).

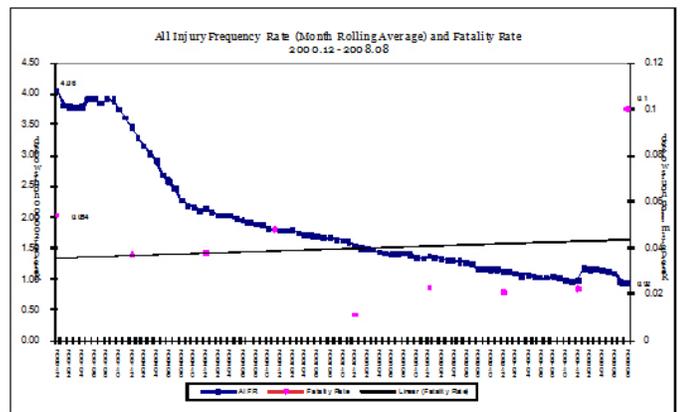
A similar pattern can be seen at the industry level, in this instance oil and gas (Figure 2 below). (OGP, 2010).

Figure 2



The same pattern can be found even more dramatically at the company level. Here (Figure 3 below), an individual company has experienced increasing rates of fatal injuries while recordable incident rates have concurrently decreased. This pattern is not unusual; in fact, it is found in many organizations.

Figure 3



Clearly this pattern raises serious questions and implications for safety leaders and stakeholders at all organizational levels, from the first level of supervision to the most senior executive and board member, to the labor leader and government regulator.

It also raises questions for one of the core assumptions of modern safety science, Heinrich's Safety Triangle. For the past 50 years or more the safety community in general has relied on this model as an accurate depiction of the relationship between types of injuries. Some observers have criticized this core concept, but those criticisms have not changed industry's reliance on it (Manuele, 2002; Anderson & Denkl, 2010). A deeper look at long standing reliance is helpful.

### The Old (Existing) Paradigm

The assumptions of the existing paradigm emanating from Heinrich's Safety Triangle (see Figure 4 below) hold that:

1. As injuries increase in severity their number decreases in frequency.
2. All injuries of low severity have the same potential for serious injury.
3. Injuries of differing severity have the same underlying causes.

4. One injury reduction strategy will reach all kinds of injuries equally (i.e. reducing minor injuries by 20% and will also reduce major injuries by 20%.)

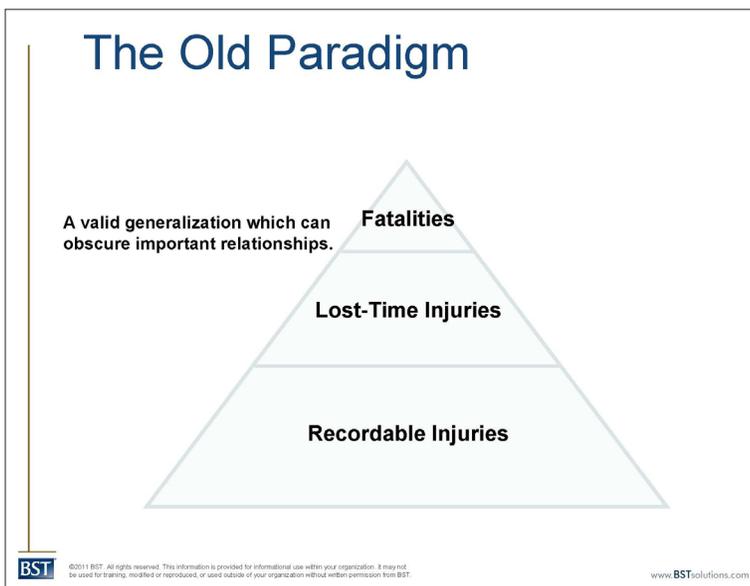
This paradigm can lead to a number of notable impacts, some positive and some negative. On the negative side, it has caused many organizations to lose credibility, internally and externally, by placing disproportionate emphasis on less serious injuries to the detriment of more serious ones. Fundamentally, the model claims two basic relationships, one descriptive and the other predictive:

1. Injury frequency and injury severity are inversely related. (Descriptive)
2. Reductions in less serious injuries will result in proportionate reductions in more serious injuries. (Predictive)

Specific questions emerged pertaining to these relationships, the existing paradigm, and a new paradigm for preventing serious injuries and fatalities. They were addressed by this present study and included:

1. Is Heinrich's Safety Triangle valid descriptively (i.e. do the data sets examined indicate an inverse relationship between injury frequency and injury severity and if they do, what are the implications)?
2. Is the Heinrich's Safety Triangle valid predictively (i.e. are reductions in less severe injuries predictive of reductions in SIFs)?
3. How similar or different are the contributing factors associated with injuries of varying severity?
4. Can precursors of SIFs be identified that will be useful to the optimal design of interventions to prevent SIFs?
5. Do findings related to these questions give useful information for the design of interventions for SIFs and if so, what criteria, principles, and methods should be used to design interventions to prevent SIFs?

Figure 4



## A New Paradigm for Understanding and Addressing SIFs

The recent pattern of declining rates for less serious injuries and level or increasing serious and fatal injury rates directly refutes the Triangle's claim that reductions in less serious injuries will result in proportionate reductions in more serious injuries. This is important because many global organizations rely on this assumption to design safety programs and processes.

Equally important, these global organizations rely on metrics that focus disproportionately on recordable injury rates to assess the comprehensive effectiveness of their safety management capability, the primary element underlying this aspect of risk management. Numerous catastrophic workplace incidents in the last several years (BP Texas City, Qinghe Special Steel Corp., Upper Big Branch Mine, Deepwater Horizon) are illustrative. In virtually every case the incident was preceded by years in which the rate of recordable injuries was low, very low, or improving.

If you had asked an executive of one of those companies "How are we doing in safety this year?" the most likely answer would have been: "We're doing great. Our recordable injury rate is lower than ever." This reflects a misunderstanding of the relationship between minor and more severe injuries, and between personnel safety and process safety. It also points to the potentially negative impacts of misapplied generalizations from Heinrich's Safety Triangle model.

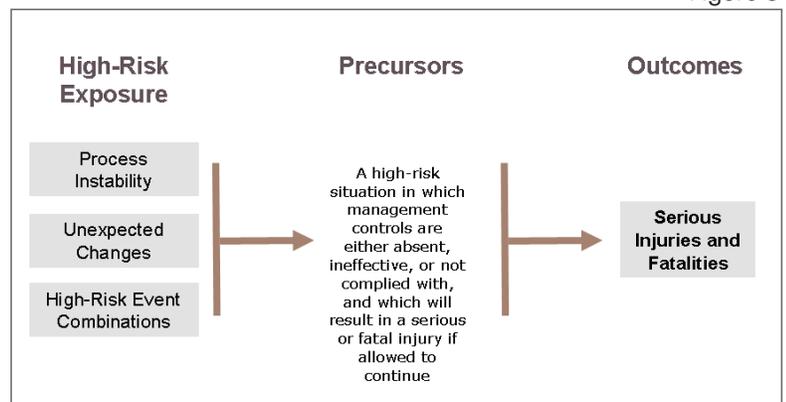
To address the negative impacts of the existing model, we established a new paradigm (see Figure 5) and designed this present study to test its validity among other noted objectives. The assumptions of the new paradigm are:

1. All minor injuries are not the same in their potential for serious injury or fatality. A sub-set of low severity injuries come from exposures that act as a precursor to SIFs.

2. Injuries of differing severity have differing underlying causes.
3. Reducing serious injuries requires a different strategy than reducing less serious injuries.
4. The strategy for reducing serious injuries should use precursor\* data derived from accidents, injuries, near misses and exposure.

\* A precursor of a SIF is defined as a high risk situation in which management controls are either absent, ineffective, or not complied with, and if allowed to continue or repeat could reasonably result in a serious injury or fatality.

Figure 5



This new paradigm suggests that a different strategy is required to prevent SIFs and that the optimal strategy for doing so is to identify and address their precursors. This can be achieved by studying exposure data, often found in reports of injuries, near misses, safety observations and audit findings. This study should be longitudinal i.e. it should study data over a period of several years in order to find themes, trends and system weaknesses.

## Findings and Next Steps

The findings of the present study suggest that the descriptive aspect of Heinrich's Safety Triangle is useful, but that the predictive aspect is not. Further, it suggests reliance on OSHA record keeping systems for categorizing injuries, used by most organizations, can hide crucially important data. More importantly, the study suggests that large organizations can study their own data and find useful information about factors that form the basis of specific intervention strategies. Moreover, the analysis of individual company data is an essential step in the formulation of an effective intervention strategy.

For those interested in theoretical knowledge about the broad relationships between types of injuries across industries, more study is needed to replicate the findings of this study. For those interested in crafting optimal intervention strategies at the company level, analysis of their own data, using methods like those described herein, is recommended.

The findings of this study point to flaws in the way many organizations think about and subsequently address SIFs. While many organizations are aware that some non-serious, non-fatal injuries have high potential for far greater harm, few have a sufficient understanding of where to look for these types of injuries and the root cause analysis that is required to illuminate them. Intervention and understanding is needed to change the course.

It is important to note that the findings of this study do not imply that less serious injuries should be treated differently than they are presently. We are not recommending that less serious injuries be given less emphasis. The objective of this study and its findings is to lay out the criteria for viable intervention strategies, the principles upon which they should be based, and the methods by which they should be fully developed and implemented.

### Goal:

Show measurable safety performance improvement and a positive effect on the safety culture and safety leadership capability of the organization after full implementation.

Design requirements:

1. Educate key stakeholders about the unique causal factors of SIFs.
2. Measure and understand SIF-potential incident rate.
3. Identify and address the precursors to SIFs.
4. Design a continuous improvement process that is sustainable in the long term through the application of a change execution framework.

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