REDUCING EXPOSURE TO SERIOUS INJURIES AND FATALITIES: ADAPTING THE HIERARCHY OF CONTROLS

By Martin Dean

WHAT IS STOPPING YOU FROM ADDRESSING SIF EXPOSURE?

Safety improvement depends on reducing exposure. Until recently, it was assumed that all types of injuries, including serious injury and fatality (SIF) events, resulted from the same pool of exposures. Reduce exposures to the more frequent but less severe injuries, the thinking went, and you would necessarily reduce exposures to those events ‘at the top of the triangle’. The problem is that while industry did get better at reducing injuries generally (quite a lot better, in fact, over the past 20 years) the rate of fatalities has remained virtually unchanged.

New research into SIFs is helping explain why—and it has opened up new ways for organisations to apply existing safety tools to the problem of SIFs. Among those tools, the hierarchy of controls, with its structured framework of exposure reduction methodologies, offers organisations one of the most promising ways to create systematic exposure reduction for SIF events. To do that, however, organisations must overcome the barriers that have prevented the hierarchy of controls from being used to its full extent until now.

Exposure reduction activities of any type are a function of how we think about injury causation. If we think injuries are mostly caused by people being careless, we tend to focus on training solutions. If we see injuries as a result of poor equipment, we will focus on capital expenditures, and so on. When it comes to serious injuries and fatalities, industry has long relied on Heinrich’s safety triangle to describe the relationship between types of injuries. But while it turns out that the model is accurate descriptively (less severe injuries occur more frequently than more severe injuries) it is not accurate predictively (there is not a constant ratio between injury types as some people assert).

In a similar way, other assumptions about accident causation (that it’s either ‘technical failure’ or ‘human error’) or metrics (e.g. that low injury rates indicate that safety generally is well managed) are proving to be oversimplified, inaccurate, and—often—downright harmful. While every organisation is different, we have seen these assumptions lead to several common barriers to effective SIF exposure reduction:

1. Data available at www.bls.gov
2. Ibid
1. Your safety systems have a significant blind spot. Many of the catastrophic events of the last several years (e.g. BP Texas City, Qinghe Special Steel Corp., Upper Big Branch Mine, Deepwater Horizon) were preceded by years in which the rate of recordable injuries was low, very low, or improving. In retrospect, the indicators of impending disaster were available— they just weren’t detected with the measures traditionally tracked in safety performance. This blind spot can lull leaders into a false sense of security about the true state of safety performance and deflect essential resources away from trouble areas.

2. Your accident investigation processes aren’t as good as you think they are. Research shows that SIF events tend to have different causes and correlates than less severe events. In fact, only about 20% of lower severity incidents have SIF potential. Yet many organisations still conduct accident investigations as though every event could become serious and let actual outcome (rather than potential) dictate the level of attention. For example, a sprain caused by manual lifting (low SIF potential) will be given the same resource and attention as a sprain caused by movement to avoid being struck by a moving forklift (high SIF potential). The result is a ‘flattening’ effect as organisations dilute resources to give all events equal resources, rather than assure events with more serious potential get proportionately greater depth of investigation.

3. Our organisation treats serious injury and fatality events as ‘one-offs’ rather than part of a pattern. We often hear leaders say, ‘Accidents sometimes happen’ or ‘We don’t know where these events are coming from’. These leaders aren’t callous. Many are deeply troubled by the persistence of SIF events. What’s really happening is that leaders have been hamstrung by a paradigm that misrepresents the nature of SIF events and fails to ‘connect the dots’ to the bigger picture. The circumstances that lead to an SIF event are complex and their precursors can exist for a long time. Complicating the matter is that SIF events are much less frequent than less severe events, making data analysis challenging.

4. Your organisation is focused on fixing people not exposures. Often, this barrier is a function of an organisation’s view of safety generally. If safety is not valued or not well connected to the mission of the organisation (or in some cases, if it is seen as a burden), there will be little investment in developing safety professionals, engaging leaders in safety, or integrating safety activities with operational practices. This barrier is often manifested within the hierarchy of controls as a lot of corrective actions focused on the bottom tiers, where reliability is highly dependent on employee behaviour.

Removing these barriers to SIF exposure reduction relies on addressing the particular barriers themselves by first recognizing the power of the hierarchy of controls.

**USING THE HIERARCHY OF CONTROLS TO REDUCE SIF EXPOSURES**

The goal of any exposure reduction activity is to isolate the worker, as much as possible, from exposure to risk. Some ways of doing this are more effective and reliable than others. The hierarchy of controls is the logic essential for determining which controls are necessary. While the logic is simple—use the highest level of control whenever possible and supplement with lower levels of control as required—the application of the hierarchy of controls must be carried out with consideration given to actual budgets and financial realities along with the urgency for the solution. When it comes to SIF exposures, the highest control possible must always be used. Sometimes multiple controls are used.

The tiers in the hierarchy of controls span a range from most to least effective [Figure 1]. As you would expect, the focus of the control also changes as you progress down the hierarchy. Tiers of the hierarchy can be roughly grouped into those steps that are exposure focused and those that are employee focused:

**Exposure-focused controls**

These controls minimize or eliminate the role of behavioural variability (that is, their effectiveness doesn’t depend on what employees do to work).
• **Elimination** — Removing exposure to the hazard in a way that is not subject to behavioural variability, e.g., redesigning a system to remove the exposure.

• **Substitution** — Replacing the hazardous element with an alternative, e.g., changing out a toxic material with a non-toxic material.

• **Engineering controls** — Using hardware systems to reduce exposure, e.g., enclosures to isolate equipment, ventilation systems, machine guards, and safety interlocks. While there is still some behavioural variation in the effectiveness of this approach (since the controls must be in place and maintained), the reliability is higher than with PPE or Administrative Controls.

**Employee-focused controls**

These controls are centred on employees, meaning that their effectiveness is dependent on behavioural variability. **Administrative controls** — Using procedures to reduce exposure, e.g., requiring work permits for high-hazard tasks or limiting the amount of time an individual may be exposed to a hazard. While more reliable than PPE, this approach is still highly dependent on behaviour; the procedure will do little good unless it is followed rigorously and consistently.

• **PPE** — A variety of personal protective equipment, such as hard hats, protective gloves and suits, respiratory protective equipment, fall protection equipment, face shields, and flame-retardant clothing. PPE is widely used in a variety of applications and has a useful place as part of the overall safety strategy. It also has the lowest behavioural reliability.

• **Gimmicks, incentives, hollow threats** — Attempting to change exposure by motivating employees to ‘work safely’.

When it comes to SIF prevention, organisations must first look to exposure-focused controls. Yet, too often, the corrective actions recommended for events with SIF potential focus on faster, less expensive (and less reliable) remedies, such as requiring PPE or sending employees for more training.

**ENABLING STRONGER EXPOSURE CORRECTION**

There are several things leaders must do to ensure effective use of the hierarchy of controls:

1. **Provide thorough and on-going training for those who do incident investigations.**

Safety professionals and others who conduct incident investigations are the first line of defence in SIF exposure reduction. Make sure that your team is well educated about the importance of potential, the distinct nature of SIF events and their precursors, how to recognize SIF potential in an event, and how to identify remedies for SIF exposures as close to Elimination as possible. Once you have identified a case that has SIF exposure, your investigators will need the tools and training to analyse it deeper than non-SIF events, conducting a deeper root cause analysis.

2. **Transform the accident investigation process.**

Too often, an accident investigation is a dry, transactional process that describes the bare bones mechanics of an event. People who weren’t there and who aren’t close to the work will have trouble understanding the urgency or picturing the context. One of the most powerful things you can do to improve the accident investigation process and strengthen the actions that result is to train investigators to write compelling case narratives that allow the reader to...
visualize what happened. For example a case that is typically written as:

An employee was operating a front-end loader when it slipped on the road and the driver hit the cab pillar head-on.

Might be written as:

The employee was driving a front-end loader in the north section of the mine. Since it had just rained, a section of the roadway had eroded away, creating a three-foot drop. The employee was driving west when another vehicle was coming east and the driver had to move over to let the vehicle pass. When he did this, the right two wheels of his vehicle went off the road and caused the front-end loader to lurch to the right, resulting in the employee hitting his head on the pillar. He could have been killed or crushed had the vehicle rolled over.

Compelling case narratives help SIF cases stand out—and signal to leaders and other key stakeholders the need to take action.

3. **Give visibility to SIF exposures.**

Making progress toward SIF reduction depends on visibility. Some organisations use an SIF exposure rate to supplement other reporting and help guide decision making and strategy. An effective SIF rate captures data to measure the rate of exposure to SIFs—both the exposures that resulted in an actual fatality or serious injury plus those that have the reasonable potential to result in an SIF. Measuring the rate of potential SIFs expands the number of data points to a level where we can observe patterns and take action.

4. **Participate in the investigation process.**

Your objective as a leader is to control every exposure with the most behaviourally reliable approach possible, where both technical and economic feasibility often enter into the decision about what is possible. Make it a habit to question decisions made about exposure control strategies. Were higher reliability alternatives considered? If relatively low reliability solutions were selected, are there longer-term alternatives that will employ higher reliability strategies? While not every exposure can be addressed through elimination, neither should every exposure be addressed through PPE.

5. **Take the lead.**

Ultimately, leaders are responsible for making sure that the exposures are addressed. When SIF-potential events do happen, leaders must stay involved both to understand the circumstances and to closely follow the corrective and protective actions from recommendation to execution. The lessons learned from an SIF-potential event are also an opportunity to transform the culture around exposure. How leaders communicate the event, what was learned, and its implications will help shape how people see and respond to future exposures.

**CONCLUSION**

Adapting the hierarchy of controls to reduce exposure to serious injuries and fatalities requires us to rethink our approach to incidents. Considering SIF potential, recognizing organisational influences on behaviour, and re-examining how we think about causation are all essential elements needed to mitigate the dangers that lead to life-altering accidents.

The hierarchy of controls gives us a good plan of attack. Starting first with the things we can do to eliminate exposures before an employee even steps foot on the worksite helps us remove risks without relying on the actions of individuals. Leaders can apply controls effectively when they have the right information (e.g. SIF exposure data), build a strong investigation process with knowledgeable people providing operational insight, and take an active hand in both investigation and planning. Leaders are the guiding light for how the organisation handles events that have occurred and how it goes about building a culture that is expert at eliminating future risks. The well-being of every employee depends on leaders’ constant vigilance.

---


www.dekra-insight.com