Preventing Major Losses

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Introduction

The Kimberly-Clark Corporation has established a high-level strategy to eliminate and sustain zero fatalities in K-C workplaces by 2015. In 2010, we will apply two tactical approaches globally. The first initiative called Sentinel Events is a method designed to actively engage every employee in K-C in the recognition, reporting, identification and mitigation of incidents that had the potential to result in a workplace fatality. Through active reporting and sharing of solutions, fatality potential in daily work activities gains visible recognition by employees and leaders and drives prioritized corrective action. The second initiative we will apply is called Preventing Major Losses which is covered in this session. Preventing Major Losses, or PML, is an advanced safety process that proactively identifies hazard scenarios that could result in a workplace fatality, permanently disabling injury/ illness or major monetary loss of materials, equipment, or other property. The PML process and tools are intended to be used by those in leadership positions, engineering roles, safety roles, and informal maintenance and operations leads on the shop floor. It is supported by robust hazard identification and risk assessment tools to aid trained and certified personnel in their pursuit to mitigate major loss risks.

Industry as a whole has done a tremendous job reducing its reportable injury incident rates both domestically and internationally. The efforts associated with these reductions are truly significant and worthy of recognition. Unfortunately the majority of business leaders and team members also subscribe to the belief that reducing reportable injury incident rates will reduce the chances that a fatality or other major loss will occur. This belief is simply not supported by the loss facts within general industry.

If your industry or business cannot come to grasp with why you continue to experience permanently disabling injuries/ illnesses, on-the-job fatalities and/or major property losses while you continue to celebrate continued yearly declines in your reportable injury rates and one million or more hours without a Lost Time Injury consider this: *Our current safety processes are designed to deliver exactly what we are getting.* If we want a different result, <u>a better result</u>, we must change the process.

Preventing major losses is a change in how we think about major losses (fatalities, permanently disabling injuries/ illnesses, major monetary losses of materials, equipment or property). It is a process that focuses on the low probability–high severity events that can and will occur within our workplaces. PML looks beyond the typical physical conditions by also incorporating work practices and process safety. The hypothesis for PML is initial reduction in the number and severity of major losses where PML is fully implemented and longer term the elimination of employee fatal incidents and reductions in permanently disabling injuries/ illnesses and property losses. This will be accomplished through changing how leadership and employees think about the hazards and risks in our workplaces, through the implementation of the PML inspection process and through expanding our teams' capabilities.

Dimensioning the Real Problem

All of us should be keenly aware of our results: the number of fatalities, permanently disabling injuries/ illnesses, losses from fires and so on. But what is measured in your industry or business? Reportable incident rates and lost time injury rates? How about Severity rates? But if we look at our performance from a fatality rate standpoint versus the national averages in some of the countries where we may operate, the problem of not focusing on fatality elimination comes into perspective.

United Kingdom (2008/2009) ………………. ..0.6 fatalities per 100,000 workers
(Represents a statistically significant decrease compared to the average rate for the previous five years.)

Australia (2007/2008) 1.2 fatalities per 100,000 workers

***United States** (2008)* ………………………….. 2.5 fatalities per 100,000 workers
(Manufacturing Only, lowest reported number of fatalities in 6 years)

Kimberly-Clark Corporation **3.3 fatalities per 100,000 employees**
(Includes all Global Operations)

United States (2008) ………………………… 3.6 fatalities per 100,000 workers
(All Private Sector - Private industry, Construction & Agriculture)
[While the 2008 results are preliminary, this figure represents the smallest annual preliminary total since the Census of Fatal Occupational Injuries (CFOI) program was first conducted in 1992.]

Canada (2005) 6.8 fatalities per 100,000 workers

Mexico (2004) ……………………………….. 9.0 fatalities per 100,000 workers

Figure 1. Comparison of National Level Worker Fatality Rates
(Data is from a variety of sources including HSE, BLS, ILO and other sources)

Based on these rates the odds of one of K-C's employees being fatally injured on the job this year is about 1 in 30,500. Their odds of suffering a permanently disabling injury based on the recent loss history are about 1 in 4,400. Frankly these are not good odds. Yet K-C's global reportable injury incident rate currently stands at 0.4, the lost time injury rate is 0.3 and the severity rate is 12.2.

Where is your industry or business at on this chart? What odds are your employees working under? Remember, if we want a different result, we have to change the process.

The Preventing Major Losses Process

The PML process approaches this issue from a proactive position. We must change what we believe about these types of events and then learn how to identify those hazards in our workplaces that can lead to a major loss. PML helps us to understand how to assess those hazards that we do find using very descriptive language and how we can prioritize what we need to do with our limited resources to reduce the risks of a loss occurring. The key elements for the PML process include:

<u>Element 1: Identifying Major Hazards</u>
Major hazards, the scenarios that could occur and lead to a major loss, do not necessarily have warning signs, beacons, alarms, training manuals or even guarding. These hazards may have existed since the site was opened or they may have been designed into the process or machinery. To identify them, we need to understand basic loss causation models such as the **PEME** model (**P**eople, **E**quipment, **M**achinery and **E**nvironment) and the intersecting relationship that each has on the other. This element also covers basic fire and explosion models using the fire triangle, dust explosion pentagon and failure causation examples for pressure and fired vessels.

Human error is also covered in this element and several existing paradigms are challenged. Herman Heinrich's research convinced most of us that 88% of losses are caused by "man failure." And the safety profession has perpetuated this and instilled this into most safety processes. But what is human error? What causes human error? Fred Manuele considers human errors to be system failures and Dr. James Reason and Alan Hobbs call them consequences, not just causes. We have to look deeper at our systems and processes and not stop when we reach the human error conclusion.

To close this element, instruction is provided that highlights the need to specifically identify what we consider to be a major hazard. To accomplish this we use Pat Clemens' approach of clearly stating the Source, Mechanism and Outcome for each hazard scenario that we find. Clearly we are most concerned when the outcome for a hazard scenario is a fatality or other major loss. And at this point we depart from traditional hazard identification models – the broad general list of things that can cause harm.

<u>Element 2: Why Losses Occur</u>
If you don't understand why losses occur, how can you prevent them? This element leverages Dr. Reason's Swiss Cheese Protective Barriers model (see Figure 2) to educate our teams on why protective barriers, or safeguards, are not perfect. This module is referenced again when we talk about the Hierarchy of Controls in the next element.

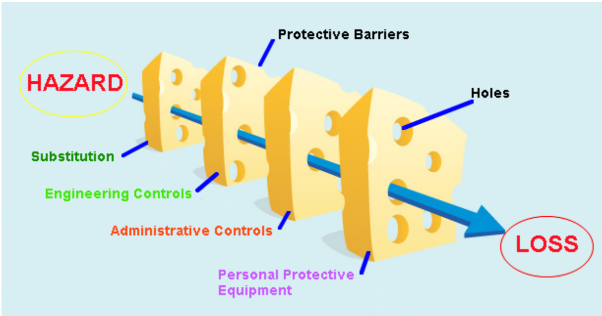

Figure 2. Swiss Cheese Protective Barrier Model (Reason)

Within the scope of PML, we need to be able to predict what can allow or cause the holes or deficiencies in our safeguards to line up or be opened. Findings should not be based on what should be in place or how a task or activity should be completed but on what the actual operating conditions and practices truly are. You must think outside of your current inspection box to see the possibilities.

Another important aspect in this element is an overview of safety cultures. Since many of us want to point to our culture as the source of our losses, we need to review a safety culture continuum and its levels and characteristics. The model we use is based on the Energy Institute's Hearts and Minds Program developed for Shell International Exploration and Production B.V.

The ladder contains five distinct levels of cultural development that may exist within a plant site or a business unit or an entire enterprise characterized by the following:

- **Pathological**: "Who cares as long as we are not caught."
- **Reactive**: "Safety is important; we do a lot every time we have an accident."
- **Calculative**: "We have systems in place to manage all hazards."
- **Proactive**: "Safety leadership and values drive continuous improvement."
- **Generative**: "HSE is how we do business around here."

Where is your site, business or enterprise at on this continuum? What are the characteristics of your organization?

Element 3: Hierarchy of Control for Safeguards

Everyone reading this is probably very familiar with the Hierarchy of Controls and their relation to providing effective safeguards or protection from hazards. But what we have found is that most of our business leaders and team members are not familiar with this approach.

In our PML process we have also defined the effectiveness of each level of control within a range. These ranges were developed using a variety of materials found in the U.K. and Australia. We then use these effectiveness ranges to reinforce why engineering/physical controls are so much better than administrative/ behavioral controls, especially when faced with hazard scenarios that could take a life or limb. The Hierarchy of Controls for PML is as follows:

- **Elimination** of the hazard: examples include the proper disposal of surplus or retired equipment that contain substances such as asbestos or PCBs, the removal of excess quantities of chemicals accumulated over time in a facility, etc. **The elimination of hazards is 100% effective.**
- **Substitution** of the hazard: examples include the replacement of solvent-based printing inks with water-based inks, of asbestos insulation or fire-proofing with synthetic fibers, the use of titanium dioxide white pigment instead of lead white, etc. **The effectiveness of substitution *is wholly dependent* on the choice of replacement.**
- **Engineering** controls: examples include the installation of machine guards at hazardous locations, adding local exhaust ventilation over a process area releasing noxious fumes, fitting a muffler on a noisy exhaust, and so on. **The effectiveness of engineering solutions ranges from 70 - 90%.**
- **Administrative** controls: include training and education, job rotation to share the load created by demanding tasks, planning, scheduling certain jobs outside normal working hours to reduce general exposure, early reporting of signs and symptoms, instructions and warnings, etc. **The effectiveness of administrative controls ranges from 10 to 50%.** *Administrative Controls typically require significant resources to be maintained over long periods of time for continuing levels of effectiveness.*
- **Personal protective equipment (PPE)**: includes safety glasses and goggles, earmuffs and earplugs, hard hats, steel-toe footwear, gloves, respiratory protection, aprons, etc. **Their effectiveness in realistic work situations *does not* exceed 20%.**

It is important to note that it is perfectly acceptable to implement short-term solutions that may include combinations of engineering, administrative controls and PPE while longer term engineering solutions are developed and implemented. These types of hazards will take time to mitigate to as low as reasonably possible (ALARP) risk levels in many cases.

Element 4: Sources of Major Loss

This element is filled with actual loss examples both from within Kimberly-Clark and from related industries. These loss examples make it real for teams and team members and leaders quickly relate to the events and circumstances. We use an approach that separates what we are looking for into eleven different Trigger groups:

- Travel/ Mobile Equipment
- Work at Heights
- Exposure to Uncontrolled Energy Sources
- Work Arrangements
- Confined Space Operations
- Hazardous Materials
- Process Modifications
- Equipment Control Modifications
- New Equipment
- Psychological
- Environment

Within each of these groupings are additional triggers that help us drill down to more specific red flag sources or mechanisms that we need to be on the lookout for in our process. For example, the Travel/ Mobile Equipment (see Figure 4) triggers include the following:

1. Travel/ Mobile Equipment

1.a. Operation of and interaction between pedestrians and vehicles
    1.a.i. Powered industrial trucks (inside & outside facility)
    1.a.ii. Vehicular traffic (auto, truck) on the grounds of a facility

1.b. Vehicle loading & unloading (trucks, railcars)
    1.b.i. Loading docks
    1.b.ii. Rail sidings
    1.b.iii. Bulk storage loading/ unloading sites

1.c. Transport of unsecured loads

1.d. Business required travel using commercial vehicle (K-C vehicle, plane, train, taxi, or bus)

1.e. Business required travel using non-commercial vehicle (personal vehicle, powered land vehicle, helicopter, or boat)

1.f. Operation of specialized mobile equipment (log loaders or other transport vehicle > 5 tons)

1.g. Commercial traffic in the vicinity of a facility

Figure 4. Example PML Trigger Listing

All of the eleven triggers and their groupings are summarized on a one-page reference that can easily be used and referred to by a PML-trained Inspector.

As stated earlier, this is a departure from the hazard identification approach that is typically used. If you try to look for and assess anything and everything that could cause harm or a loss, you and your teams will be quickly overwhelmed. That is why most of these processes fail. We have to be educated and trained on how to look for the possible sources of major losses. And it takes discipline to stay focused during the search.

Element 5: Risk Assessment

Once we identify a hazard scenario that has a possible major loss outcome or consequence, we use a risk assessment process to evaluate the risk level and for this we use a quantitative process.

There are many risk assessment tools, methods, processes, etc. available to choose from but we need one that meets the needs of the PML Inspection process, is a validated or recognized approach and also meets the needs of the teams and businesses. We also use this quantitative approach to help us prioritize what should be actioned based on the risk levels. The process we use is rooted in the Pilz Automation Technology method as outlined in their *Guide to Machinery Safety*, 6th Edition published in February, 1999.

Using this method the **R**isk Level is equal to the product of four different and independent terms:

- **S**everity (outcome),
- **F**requency of exposure,
- **P**robability (likelihood of occurrence),
- **N**umber of people exposed

Or simply: **R = S * F * P * N**

The decision scale for the various risk levels has four distinct breakpoints as shown in Figure 5 below.

Risk Score criteria	**Risk Level**
Unacceptable – Continued operation in this state is unacceptable	**500+**
High – Having potentially dangerous hazards, which require control measures to be implemented urgently	**50 to 500**
Low but Significant – Containing hazards that require control measures	**5 to 50**
Negligible - Presenting very little risk to health and safety	**0 to 5**

Figure 5. PML Risk Score Criteria

The representative values for the four terms that are used to determine the risk level are selected using easy to navigate tables and corresponding numerical values for each of the four terms. Since we are only concerned about major losses with high severity outcomes, we limit the scope of the risk analysis for those outcomes only.

We have four tables with descriptive words such as fatality, loss of limb, probable or hourly as the key words to choose from. But before these can be used, it is imperative that we teach everyone what these descriptions mean and how to correctly choose from these words. If we fail to do this our risk assessment process can become biased or provide skewed or possibly inconsistent results.

For example, when you are faced with determining the severity of a hazard scenario what do you use to assist in making that determination? Like most of us, you probably use your personal experiences and what you have learned from reading loss reports or journals. But each of us has different personal experiences and knowledge. To provide some consistency, we must determine the most credible severity (outcome) for our hazard scenarios and not the worst conceivable. To do this we use a reference from the "Abbreviated Injury Scale – 2005, Update 2008" that is published by the Association for the Advancement of Automotive Medicine to help us bridge the gap. Most safety leaders and those involved in the PML process have little to no medical training, but if we knew the types of injuries that are truly considered life threatening and those that are deemed untreatable/ unsurvivable from a credible but very easy to use reference, we can improve the quality and consistency of our decisions regarding outcomes. For example, Figure 6 highlights a few of those injuries that are considered unsurvivable.

Trauma Chart

AIS Score (listed in ISS assignment format)	6 Currently Untreatable, Unsurvivable
Head & Neck (including C1 - C7)	**Brain stem [hypothalamus, medulla, midbrain, pons] -** laceration, massive destruction (crush type injury), penetrating injury, transection pFCI = 1
	Carotid artery, Internal- bilateral laceration pFCI = 1
	Cervical spine Cord, C-3 and above - Contusion or laceration with complete cord syndrome (quadriplegia or paraplegia with no sensation or motor function), NFS, with/ without fracture, dislocation or both pFCI = 1
	Head i.) crush injury - massive destruction of skull, brain and intracranial contents ii.) decapitation pFCI = 1
External	**Body 2° or 3° burn,** partial of full thickness, including incineration >= 90% TBSA *
	Whole body (Explosion type injury) - massive; multiple organ injury to brain, thorax and/ or abdomen with loss of one or more limbs and/ or decapitation

Figure 6. Unsurvivable Injuries, Partial List

This same approach is also used for the other three terms and in particular for the term Probability (likelihood of occurrence). Many consider this to be the *Achilles heel* of this type of risk assessment – most times the level chosen is a guess, at best. The PML process had similar critics of this part of the process and to overcome these deficiencies we used a variety of references and the Hierarchy of Control itself to better define and address this term. One reference used was from King's "Safety in the Process Industries" while other references were collected from a variety of different sources. Without going into all of the details, the outcome is a chart shown in Figure 7 that our teams use to make better and more consistent decisions regarding Probability.

Probability (P) † of Occurrence	Pilz Scale Value	King's frequency per year (odds)	Probability (%)
Certain - no doubt	15	1:1	> 99
Likely – only to be expected	10	1:1 to 1:10	90 to 99
Probable – not surprising	8	1:10 to 1:100	66 to 90
Even chance – could happen	5	1:100 to 1:1,000	45 to 66
Possible – but unusual	2	1:1,000 to 1:10,000	33 to 45
Unlikely – but could occur	1.5	1:10,000 to 1:100,000	10 to 33
Highly unlikely – though conceivable	1	1:100,000 to 1:1,000,000	1 to 10
Almost impossible – possible only under extreme circumstances	0.033	> 1:1,000,000	< 1

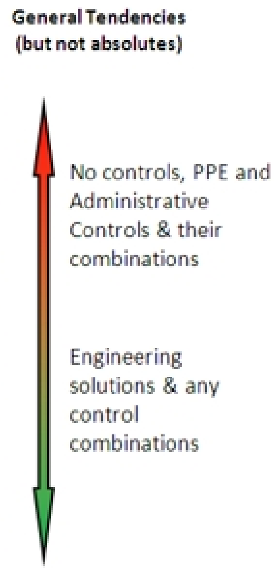

Figure 7. PML Risk Assessment Probability Scale

Within the PML Risk Assessment process, guidance is also provided on methods to determine risk levels when exposures occur simultaneously to multiple hazards.

Element 6: Taking Action
No process is complete unless we take action. That means we have to do more than conduct an inspection or make a list or prepare a recommendation for upper management. The key is to do the correct things in the correct order to best reduce the risk levels to as low as reasonably possible levels (ALARP). Our actions and solutions also have to be balanced against the costs of attaining that lower risk level. The cost to achieve ALARP may be disproportionate to the benefits attained. When that occurs, reducing the risk to a lower level with costs that are proportional to the benefits gained may be acceptable. These alternative lower cost measures may also include layer(s) of administrative controls.

The PML process defines specific hard cutoff points for risk levels and required action planning and implementation timeframes for each of those levels. For example, Risk levels above 500 are unacceptable and work must be stopped immediately until the risk level is reduced below 500 and to a more tolerable level.

This element also provides some guidance on different mitigation techniques and approaches to affect each of the four terms in our risk equation.

Practical Application of Preventing Major Losses

The first step needed to put PML into an organization is recognizing that this process can help solve the problem of major losses in the workplace. Secondly, the leadership team has to fully support the approach and be engaged in the process. Where leadership goes, others will follow.

The third step is an education and training session. We educate to help team members absorb the concepts and thought process and change what they believe about major hazards in the workplaces. We then train them on how to use the concepts in their work environments. This all takes between 16 to 20 hours in a classroom setting. But the class time also includes four group interactive exercises with one of those being an actual limited scope practice PML inspection in the hosting facility. The initial session at a site should include the hosting site's leadership team, engineers, safety team members and informal shop floor leaders.

Once a core team has been trained, there are several options on how a site may want to implement the process. This implementation plan is dictated by the size of the operation, EHS management system development, knowledge and safety education level and various other factors. As an example, the following is a description of how one business unit within the Kimberly-Clark Corporation has implemented PML.

KCP: Implementing Preventing Major Losses

Kimberly-Clark Professional's safety leadership team recognized that PML offered a systematic approach to identifying hazards that could result in major losses and took action to implement across the business unit. In order to gain leadership support, leaders were provided an executive summary of PML which explained the process, the benefits, and resource requirements. Considered the next generation of proactive hazard identification and in an effort to streamline the tools utilized, PML will replace other processes such as K-C's Major Incident Prevention and K-C's Class "A" Hazard Identification that are currently used within the business unit.

Kimberly-Clark Professional (KCP) has fifteen manufacturing locations across North America and Europe. The next step in implementing PML is to properly train key individuals at each location to be able to complete PML inspections. A PML Inspector Training Session was held at one location in Europe and another in the United States. Safety leaders and other facility resources came together for an interactive and interesting training class. Each session included practical examples, hands-on application and a competency test. Each individual successfully completing the session and receiving an acceptable score on the competency test, were certified as "PML Inspectors." K-C Professional also opted to train a select few individuals to serve as Train-the-Trainers. A Train-the-Trainer course was also held so that key facility personnel would be able to train others to become PML inspectors. This additional capability allows PML to be more rapidly implemented at each facility. Alternatively, a business unit may decide to appoint one or two individuals to train everyone to be PML inspectors. However, this option was not practical for K-C Professional.

K-C Professional has also enhanced its safety reporting software to include PML inspections to close the loop on follow-up for identified opportunities. Currently, KCP safety leadership supports the rollout of the PML at all manufacturing facilities on a schedule that is advantageous for each location. To date, feedback from facilities that have implemented PML has been very positive. Hazards not previously identified using other tools have been identified for mitigation or elimination.