Slaying Workplace Safety Costs

Using FMEA to work smarter in safety programs

Part 5 of the Stealth Quality Series

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Introduction

These are tough times. And indications are, they are not nearly over. In spite of that, workplace safety still isn't negotiable; it is not something we can suspend when cash flow and time constraints force managing priorities. The costs of getting it wrong are still too steep, and will remain that way.

What to do? This paper discusses some Lean, Value Management and human performance management methods that can be applied to safety program management to understand, confront, and solve problems that can bring big costs. The focus is on *work smarter, not harder* principles to share responsibility, and reduce safety errors and costs where they occur: in the process.

First step: Understand your opponent

The organization's problem should be defined in specific terms that have meaning to the group. Part 2 of the Stealth Quality Series (Conquering Employee Turnover) describes how to calculate employee turnover costs. Part 3 (Arresting Absenteeism costs) discusses various costs of lost employee time. When using the calculators, include direct costs such as fines and increased Workmen's Comp insurance premiums, along with time required for supervisors or managers to:

- Investigate the problem
- Fill out workplace accidents reports (OSHA requires one within 48 hours of an injury that requires outside medical attention)
- Conduct ramped up management needs involved with corrective actions

An objective evaluation of the workplace activities will be needed, and an understanding of their risk types. OSHA provides a list of risk types called Fatal Facts by Fact Number, along with an explanation of actual workplace fatal accidents that have occurred from the risks.

Money saving tip: Outsource the job. If you can't afford a consultant or safety engineer, try contacting your state OSHA office. Ask about partnership programs in which representatives come to your site, review workplace practices and recommend actions to reduce injuries and incidents. A second option may be available via your area's Workmen's Comp insurer; some are willing to visit their workplace clients, evaluate risks and suggest ways to resolve them in order to reduce the number of work loss injuries.

Second step: Plan your arsenal

A common *management-by-objective* failure is one of people trying to manage outcomes instead of causes. When they feel pressure to reduce injury rates by discipline alone, employees may suppress, ignore or hide injuries. That can make costs bigger, not smaller, when risks are compounded by long-term stress, fatigue or pressure to meet production needs while making ad-hoc efforts to avoid statistically probable accidents. This is a particular problem when workplace hazards accumulate over time, as in ergonomic stresses or chemical exposure. The organization's leadership is responsible for providing the resources needed to *reduce workplace hazards*, not just exhort its people to lower injury rates. This battle will need an arsenal in both hazard management and behavior management tools.

Hazard management using FMEA

Manufacturers have been using Failure Mode Effect Analysis (FMEA) for many years to manage and control process risks in manufacturing. The FMEA can also be used to list, analyze, evaluate, record, prioritize, plan for addressing, and re-evaluate safety risks at the points where they occur: in the processes.

The FMEA can appeal to a number of needs, such as:

- Familiarity. Whereas safety engineering is considered a near-mystical science, process engineering using FMEAs is well defined and documented in Lean Manufacturing.
- Training. Material for teaching how to use the FMEA is abundant, and the learning curve for applying the method to safety can be shortened to a size that feels scalable.
- Delegating. By managing their own area or process FMEAs, supervisors and managers can list, quantify, understand, prioritize and address their own areas' injury risks.
- Showing and sharing results. The FMEA can show results in both process efficiency and cost savings. The FMEA was designed to serve as an information warehouse, but its benefits can be made personal: managers can refer to it for data at evaluation time. Supervisors who are interested in showcasing their successes can use the FMEA as a place to do so. If needed, the FMEA can be used as a tool for analyzing mishaps or accidents. As a worst-case scenario, it can be used to show OSHA investigators how the organization worked to address risks and exhibit due diligence during appeals.

As with Process FMEA planning, the Safety FMEA has a planning portion. Fill in the:

1. Task description (part of the overall process)
2. Description of the hazard/risk, and the potential injury
3. OSHA and/or state codes that help provide guidance
4. Classification: Chemical, trauma, or ergonomic. If there is more than one classification possible, list each on their own lines.
5. Known cost, if an injury/mishap has already occurred and its cost is known.
6. Current process ***Severity, Occurrence*** and ***Deterrence*** controls. See Tables 1 through 4 for an explanation of what to enter.
7. Current hazard controls and Recommended Action for further, improved controls.

Figure 1 shows a sample risk analysis portion of a workplace Safety FMEA.

Figure 1: A sample Safety FMEA for a foundry shop's grinder process.

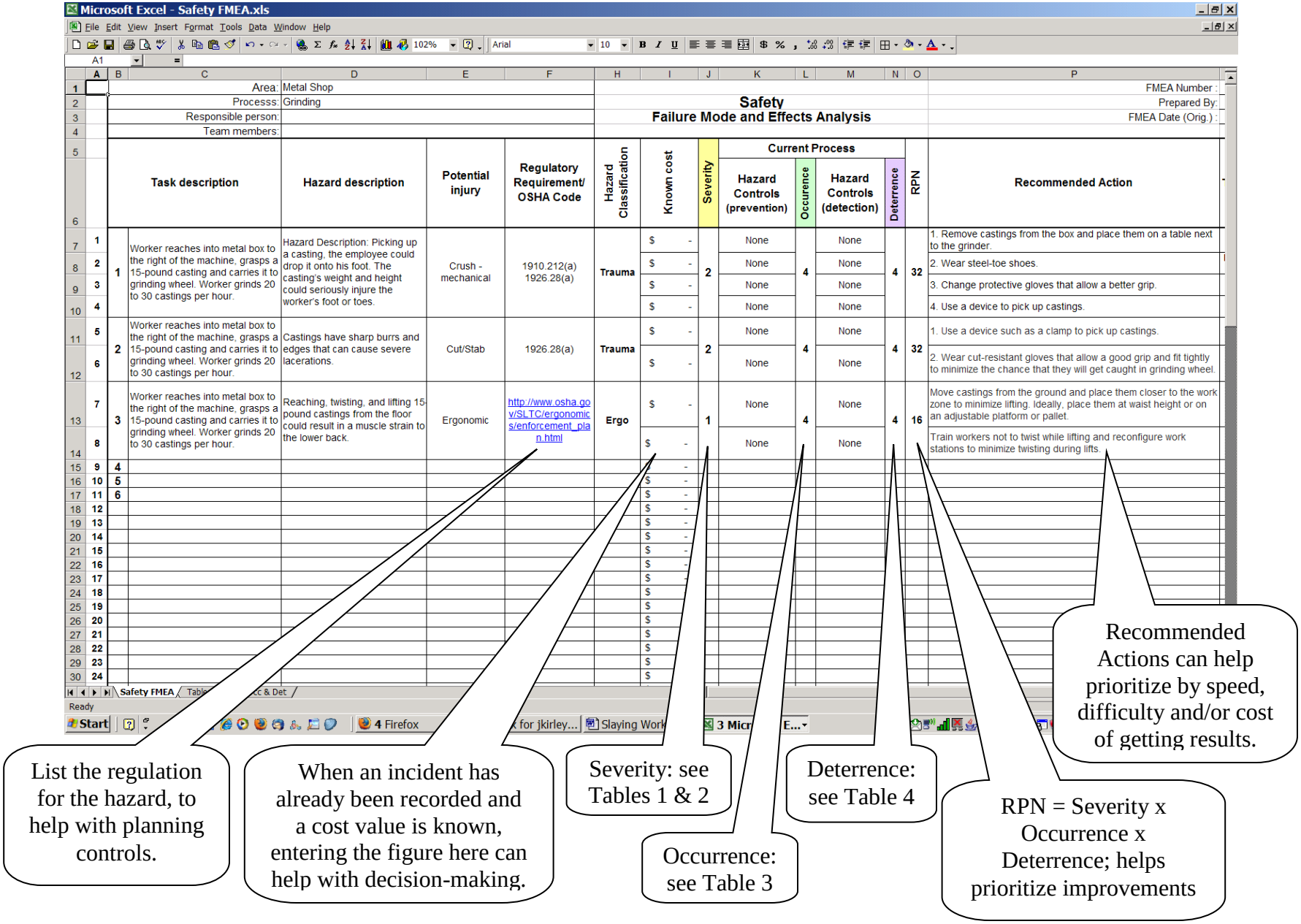


Table 1: Evaluating Severity for chemicals and substances

Severity: defining **chemical or substance** risk levels using DOT criteria Refer to the Material Safety Data Sheet (MSDS).					
	0	**1**	**2**	**3**	**4**
Red: Fire hazard	Will not burn	Flash Point above 200° F	Flash Point above 100° F, not exceeding 200° F	Flash Point below 73° F (Boiling point at/above 100° F) and/or at/above 73° F, not exceeding 100° F	Flash Point below 73° F (Boiling Point below 100° F)
Yellow: Reactivity (Instability)	Stable	Unstable if heated	Violent chemical change	Shock and heat may detonate	May detonate
Blue: Health	Normal Material	Slightly Hazardous	Hazardous	Extreme Danger	Deadly
White: Specific Hazard	OX or OXY: **Oxidizer** (No number values are assigned)		W (with line through it) **Use no water** (No number values are assigned)		

Table 2: Evaluating Severity for physical risks

Severity: defining **physical** risk levels					
	0	**1**	**2**	**3**	**4**
Trauma injury	No identified hazard	Remote or isolated hazard.	Immediate extremity hazard.	Immediate serious injury hazard	Immediate disability or death hazard
Ergonomic injury risk	No identified hazard	RULA Score 1 or 2	RULA Score 3 or 4	RULA Score 5 or 6	RULA Score 7
Source for RULA risk evaluation (XL worksheet): **http://ergo.human.cornell.edu/ahRULA.html**					

Table 3: Evaluating Occurrence: accumulated exposure

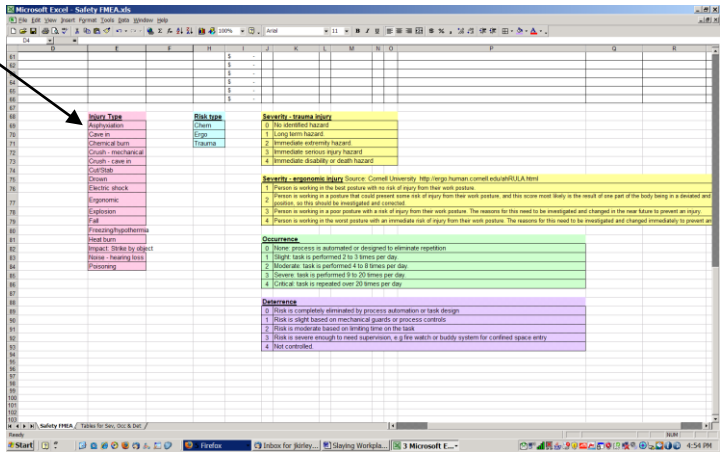
Occurrence: defining accumulated risk exposure levels				
0	**1**	**2**	**3**	**4**
None: process is automated or designed to eliminate repetition	Slight: task is performed 2 to 3 times per day.	Moderate: task is performed 4 to 8 times per day.	Severe: task is performed 9 to 20 times per day.	Critical: task is repeated over 20 times per day

Table 4: Evaluating Deterrence levels: risk mitigation

Deterrence (used instead of *Detection*): defining control levels				
0	**1**	**2**	**3**	**4**
Risk is completely eliminated by process automation or task design	Risk is slight based on mechanical guards or process controls	Risk is moderate based on limiting exposure to the hazard	Risk is severe enough to need supervision, e.g fire watch or buddy system for confined space entry	Not controlled.

Adapting your FMEA: You can adapt the Safety FMEA's dropdown menus. Add, change or delete items in the colored cells that the template tool is set up to list:

Figure 2:
Tables for drop down menus

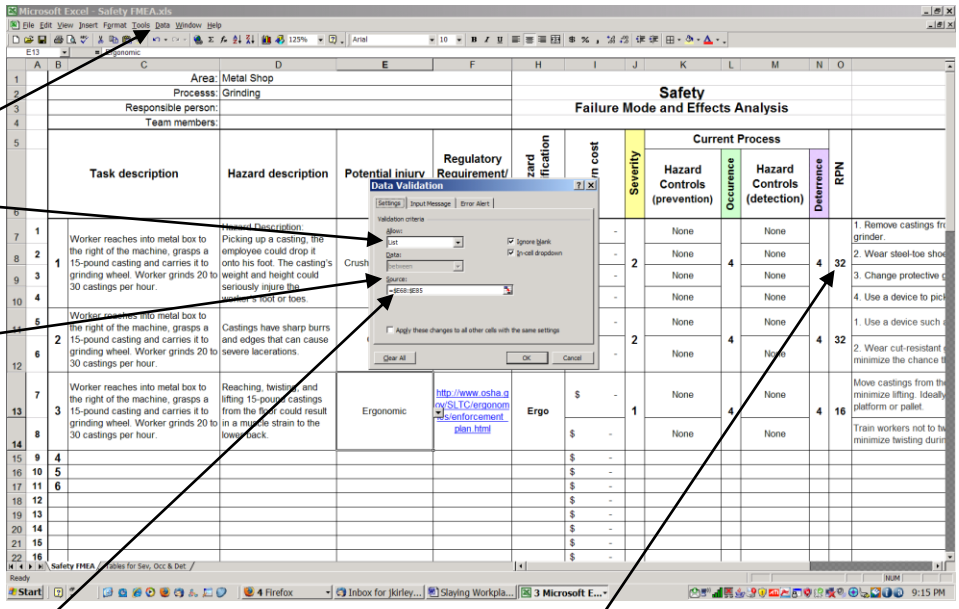


Formatting the drop-down menu

Figure 3: Formatting drop down menus

Select the cell you want to add a drop-down menu to. Left-click on Data, then Validation, then Allow: List.

When you select "List", a field called "Source" will pop up. Select the range of cells on your spreadsheet that contain the dropdown data; its source will appear in the window: in this case, =E70:E86.



When adding or subtracting items in the dropdown, update this source (cell selection list).

Click "OK".

The formula for this task's RPN is =IF(I7*K7*M7=0,"",I7*K7*M7)

Third step: Confrontation

Controlling risk at the task level

Now that tasks have been described, regulations for them listed, existing costs listed (if known), and risk factors evaluated to reach RPN, you can prioritize the opportunities for improvement.

The RPN values in FMEAs are used to prioritize. The template tool is set up to calculate RPN as Severity x Occurrence x Deterrence. Since the template is set up with dropdown menus based on a 0 to 4 score, the Safety FMEA RPN's maximum possible value is 64.

Although RPN is typically used when deciding what improvement to target in FMEAs, other options can also factor in:

- Ease, cost and/or time needed for getting the change implemented
- Ability to address more than one failure mode at the same time, e.g. protective equipment
- Value; calculate using the formula: Value = Savings ÷ Cost, or Value = Cost ÷ Savings.

Engineering Controls are the first line of defense in protecting workers from hazardous exposures. Methods that can be used to, for example, reduce or eliminate exposure to lead can be grouped into three main categories: (1) substitution; (2) isolation; and (3) ventilation.

1. *Substitution.* Examples include:
    - Using a less hazardous material: for example, a lead substitute fuel additive for heavy equipment.
    - Change in process equipment involves using less dusty methods such as vacuum attachments for tools and equipment, wet abrasives and cutting, or chemical stripping to substitute for processes that generate harmful dust.
    - Change in process: performing demolition work using mobile hydraulic shears instead of a cutting torch to reduce exposure to lead fumes generated by heating lead compounds.
2. *Isolation* is a method of limiting chemical exposure to those employees who are working directly with it: for example, personal protective gear and containment structures.
3. *Ventilation,* either local or dilution (general), is probably the most important engineering control available to the safety and health professional to maintain airborne concentrations at acceptable levels.

Work Practice Controls involve the way a task is performed. OSHA has found that appropriate work practices can be a vital aid in lowering worker exposures to hazardous substances and in achieving compliance with the PEL. Some fundamental and easily implemented work practices are: (1) good housekeeping, (2) use of appropriate personal hygiene practices, (3) periodic inspection and maintenance of process and control equipment, (4) use of proper procedures to perform a task, (5) provision of supervision to ensure that the proper procedures are followed, and (6) use of administrative controls.

1. *Housekeeping*. Schedules for housekeeping should be adapted to exposure conditions. Housekeeping involves removing accumulating hazardous dust and contaminated debris.
2. *Personal Hygiene Practices*. When employees are exposed to chemicals like lead dust in the workplace, PEL (personal exposure levels) are monitored. OSHA directs employers to use measures to control exposure, such as:
    - Change Areas
    - Showers
    - Washing Facilities.
    - Eating Facilities.
3. *Periodic Inspection and Maintenance*. This includes process equipment and control equipment such as ventilation systems, as well as safety equipment and facilities systems.
4. *Performance of Task*. The employer must provide training and information to employees as required by OSHA's standards. Workers must know how to properly perform tasks to minimize their exposure to lead and to maximize the engineering controls' effectiveness.
5. *Supervision* involves providing needed support for ensuring that workers follow proper work practices.
6. *Administrative Controls* generally involve scheduling of the job or the employee. One method is to schedule the most dust, fume or vapor producing operations for a time when the fewest number of employees will be present. Another method is worker rotation. Rotation involves rotating employees into and out of risk areas in the course of a shift, reducing the full-shift exposure of any given employee.

Fourth step: The battle

Human Performance Management: intrinsic and extrinsic motivation and reward

People tend to respond to a desire for reward of some kind. For some, the fuzzy feeling of satisfaction comes from just knowing a person they value is safer, happier and more prosperous by avoiding injury. Management can help promote intrinsic motivation by allowing front line supervisors and managers to have a direct impact on their employees' well being. Providing adequate resources can help show their support. Openly celebrating success can help spread the good news as examples for other first level managers to use and build on.

With extrinsic motivation, rewards come from the outside: bonuses and favorable performance reviews are common, but other possibilities are available, and not all are expensive. The 1,001 Rewards & Recognition Fieldbook (Nelson & Spitzer, 2003) contains insights of affordable and creative incentives. Keep in mind, however, a general rule of thumb: the more that cash flow pressures people, the more they tend to favor cash rewards. Lower paid employees will often best appreciate the type of recognition that eases their personal problem: money. If real bottom-line savings are achieved by reducing Workmen's Comp premium costs, sharing a portion of that with line workers and their supervisors could help to gain team based efforts and invite positive peer pressure. Failure to share benefits with employees could reduce cooperation or slow future efforts. After all, employees are often well aware of the efforts they have put into improvements;

they also understand insurance costs and will be aware that their employer has benefited from their projects.

The organizational safety partnership

Even after doing what we can to engineer processes and tasks to improve their safety, we need employee cooperation to reduce accidents and minimize Workmen Comp costs. In high-risk industries such as construction and shipbuilding, developing an organizational safety partnership can help plant the mind set of safe behaviors. In The Enthusiastic Employee (pp.285-300), Sirota et al. recommend a nine-step step approach to planning an organizational partnership:

1. Establish, and keep in mind, the business goal as a rudder for the partnership. To be useful, the business goal should be consistent with the way the organization understands partnership and its expected effects.

2. Establish readiness. The partnership building process can be long and demanding. Honest self-diagnoses will more likely succeed than superficial glances or assumptions that ignore basic issues. Management openness to employees' critical input is essential.

3. List wants and objectives using the honest learnings from introspection done during the *establish readiness* step. Form clear, specific, and comprehensive statements of what is desired and why; keeping consistent with the organization's purpose and principles can help. Sirota advises that senior management develop the statements so the work force can identify them as top management's thinking and intentions.

4. Identify the current situation. Sirota advocates a comprehensive set of measurements to understand the conditions, and not merely management's views of the conditions.

5. Define what needs to be changed. Use the measurements in Step 4 and the introspection in Step 3 to identify which organizational aspects to target for partnership development. Three principles to help guide the decisions are:
    a. View partnership as a total system; many partnership elements are interdependent.
    b. Do something visible fairly quickly to establish good faith among the skeptics.
    c. Adequately resource the changes needed to develop the partnership; allow time to develop and introduce them. Keep in mind the plan should be dynamic; allow changes to the plan over time as needed.

6. Carefully plan the basic plan's communication; balance management's high hopes with a realistic recognition of the hard work needed to succeed.

7. Use task forces to develop specific changes that need to be made, and plans to implement. To forestall employee resentment of painful changes where they exist, task forces should represent a "diagonal slice" of the organization, each with a senior management leader.

8. Prepare managers for their own changes in the new partnership, especially where cultural, behavioral and organizational practice changes are called for. Plans for changes among senior management should be made and adapted according to the organization's circumstances and objectives, as well as managers' individual needs.

9. Plan for evaluating success with methods that record sincere attitudes and trended outcomes. Use a mix of measurement methods often enough to understand needs to maintain or change course. Share success!

Like with Process FMEA planning, the Safety FMEA Action section includes places to record:

1. Who is responsible to do what, and when
2. What action is taken, and when
3. Changes to Severity, Occurrence and/or Detection
4. A re-calculated RPN.

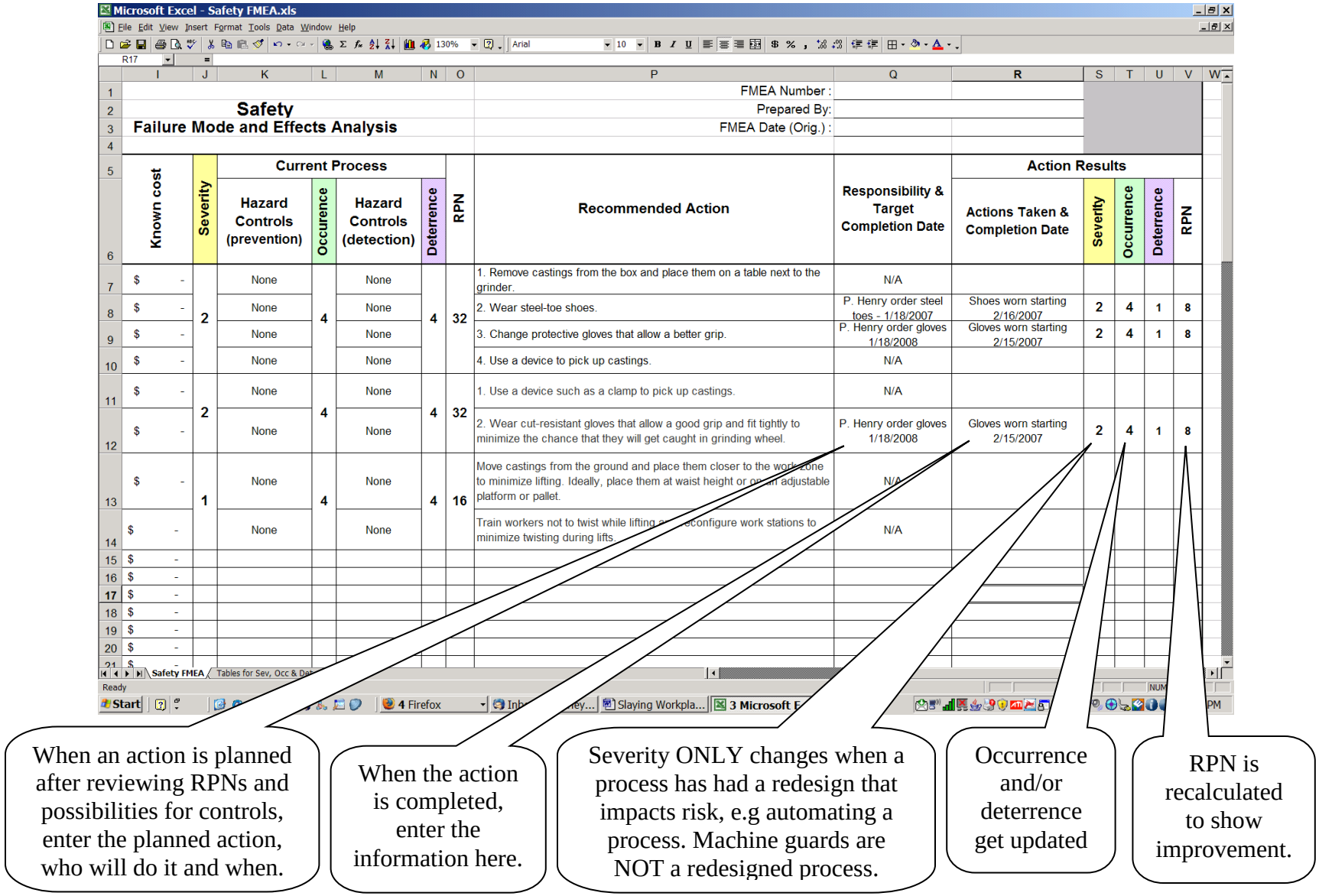
Note: **Severity is only changed when a process redesign impacts risk.** Redesign includes changes such as automation, but does NOT include barriers like machine guards.

There are inevitable cases where human behavior plays a critical role in managing safety risk. Choice ranges from deciding to don the safety harness before climbing onto the roof, to lifting using the legs versus the back. Tools and equipment are generally more effective for safety risk management than simply telling people to do their work differently, but only when they are:

- The proper design and size for the need
- In good working condition
- Easily accessible
- Reasonably convenient and easy to use
- Understandable – training will often be required, even to understand the proper gap for a machine guard.

Figure 4 shows the Action part of a workplace Safety FMEA.

Figure 4: Action part of the Safety FMEA



What next? Moving from small *s* to big *S*

Total Safety Management (TSM) is a performance-oriented approach to safety management that can boost the organization's competitive edge by holistically establishing a safe and healthy work environment. The resulting competitive edge can boost appeal to both sales and employment markets, and raise the organization's prestige in the community. When community approval improves, organizations can find easier going when proposing expansion plans to municipal planning boards.

Moving from traditional safety management to TSM can radically improve safety standards and reduce the costs of accidents. Key practices in TSM include:

1. Empowerment: Give employees the authority, information, skills, and support to do their jobs safely.
2. Employee Involvement: Use employee participation techniques to involve everyone in the process of planning and deciding.
3. Teamwork: Bring employees together to learn together, and to improve their safety awareness and practices.
4. Training and Development: Use individual and team development processes, including formal and informal training.
5. Recognition: Identify, recognize and reward positive results that support the safety mission.
6. Replicate Success: Share internal successes and external benchmarking as a continuous challenge to improve safety. (Cox, 1992)

Injuries can cost more than we might think. The average lost-time injury in Ontario cost $59,000 in 2002. In 2006, the cost was approximately $98,000. Direct costs to the Workplace Safety and Insurance Board (WSIB) account for about 20 percent of that figure.

A business operating on a 6 per cent profit margin in 2002 would have needed nearly a million in sales to make up for the $59,000 lost that year from a single injury. Today, that same business could need over one and a half million in sales to recover the costs of a single injury (WSIB).

Organizations depend on skilled and trained workers. We can protect our workers and their families from the suffering and costs caused by workplace injuries while we protect our businesses from the high cost of injuries.

Safety gear—2 minutes ... Risk assessment—5 minutes ... A mishap that takes a life—forever.
Naval Safety Center

Help sources:

Compliance Assistance — Occupational Safety & Health Act of 1970

OSHA Technical Manual for Health Hazards: Hospitals

Rapid Upper Limb Assessment (RULA) explained: http://www.rula.co.uk/offline.html

RULA risk evaluation (XL worksheet): http://ergo.human.cornell.edu/ahRULA.html

Resources

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