

COST BENEFIT ANALYSIS

WHAT IS A COST BENEFIT ANALYSIS?

A cost benefit analysis, simply put, is the monetary or safety valuation of the risk of performing a task (or performing a task in a certain way) vs. benefit of performing the task (or performing the task in a certain way). One of the simplest examples is the use of gloves when performing maintenance on a mechanical saw. What are the risks of not wearing gloves? What are the benefits? A maintenance person may contact a saw blade during the performance of their work and cut themselves. Gloves will protect the maintenance operator from cuts or severe lacerations, but the gloves may also impede the maintenance operator from accessing small parts or points within the machine, making their task that much more difficult. Weighing the risks and benefits is sometimes a confusing, and complicated, process, and is not just a monetary or financial decision. Financial decisions many times determine whether or not equipment or machinery is replaced. A simple return on investment (ROI) strategy is one of many types of investment information that would go into a financial decision. A cost benefit analysis is more than a return on investment strategy, there are many other factors that influence a decision. Safety is one of these factors.

A cost benefit analysis is sometimes confused with a return on investment (ROI) process. A ROI is a type of investment strategy and is generally used to determine if new machinery or equipment is a good investment over time, rather than for a safety and health evaluation. For example, a mechanical saw may require \$5,000 in repairs (new engine, belts, blades, guards, etc.), \$100 each year in maintenance and would produce 100 units of per month. A new saw would cost \$15,000, require the same \$100 in maintenance costs each year, and would produce 120 units per month. If the company received \$25 per unit, the additional revenue would be \$2,500 each year. Additionally, the company could write off the depreciation of new equipment at 10% per year. The new saw would pay for itself after 2 years. (\$6,000 additional product per year, plus \$1,500 tax write off, equals \$7,500. Multiply by 2 years equals the \$15,000 investment in the new saw). If the life of the saw is estimated at more than 2 years, then the ROI is favorable. If the life of the saw is only 2 years, then it is a break-even ROI. If the life of the saw is less than 2 years then the ROI is negative and the company would be better off maintaining the old saw.

However, if the saw is a safety hazard (for example the bolt-holes are stripped and won't hold the blade securely) and there is a risk of injury from use, then the valuation of a new saw is increased. If the potential for an injury (risk) is severe, then the value of a new saw is significantly increased and would easily outweigh the monetary cost of maintaining the old one. The value is no longer just a monetary calculation, and the value is heightened by the protection of worker safety.

HOW DO YOU PLACE A VALUE ON SAFETY?

The safety of employees should be the top priority of any company. However, there are higher risks to some jobs or tasks than others. For example, electricians that work with

high voltage are at greater risk than those that work on low voltage operations; even with protective equipment, the risk is inherently greater.

Evaluating the level of safety in a job or task (or the general safety of a company) can be complex. The likelihood of an injury occurring must be weighed against the severity of the potential injury. Frequently that process is somewhat subjective. However, there is an established hierarchy of protection that is very commonly used in industry. This hierarchy starts with engineering controls. Engineering controls include both removing risk and increasing safety measures. It is less expensive, and usually inherently safer, to engineer in from the design stage, rather than after machinery or processes has been installed. Engineering controls include machine guarding, substitution of a less hazardous material or chemical, interlocking controls, emergency stops, etc. The second hierarchical step is administrative controls. These include written procedures, training, limitation of exposure through time or job rotation, audits, inspections, etc. The third step in the hierarchy is the use of personal protective equipment. These include noise barriers, safety glasses, clothing, gloves, respirators, welding shields, etc. Personal protective equipment should be the last step in employee protection, engineering controls are always preferred. If the hazard does not exist to begin with, or is engineered out, then lesser effective protection methods (such as administrative or PPE use) are unnecessary.

The value of safety is not transparent to a company. If an employee is injured on the job, not only is the employee out of work (for which he is collecting a salary), but there may be medical costs associated with the absence. The productivity of the employee is lost, and may be required to hire additional (temporary) replacement labor. This replacement person will need to be properly trained before they can start, as well as their productivity will probably not be as good as the regular employee. These are examples of “direct costs”, but there may be additional “hidden costs” that a company will still experience. These hidden costs include items like an increase in insurance liability rates, the time to fill out any worker’s compensation forms, accident investigation, reporting to appropriate agencies, and filling out the OSHA recordable incident reporting log, among others. Other hidden costs may need to be accounted for as well. Such costs include a reduction in productivity from other workers at the company as a result of the incident. Employees who feel safe on the job are more productive and experience less absenteeism than in places where they feel their safety may be in jeopardy.

The OSHA website has an e-tool available to assist small businesses in estimating injury costs (http://www.osha.gov/SLTC/etools/safetyhealth/mod_estimating_costs.html).

HOW DO YOU ASSESS RISK?

Risk is defined as volatility. Whether it be good or bad, there is a certain amount of volatility in any endeavor (financial investment, climbing a tree, running a machine). In the safety and health field, risk is generally considered to be the combination of the likelihood of an incident and the potential severity of the incident. There are two easy methods to evaluate risk. Both of these methods would enable a company to determine which tasks have the highest risks, and therefore should be addressed as a priority to reduce or eliminate the risks involved. The first is a relative valuation method and the

second is the four square method. Both these methods will enable a company to prioritize their investment in safety to achieve the best results from a time or financial standpoint.

Relative valuation method:

A simplified method of assessing risk in terms of worker safety is the valuation method. Simply put, you place a value of 1-10 on how likely an injury would be, and a value of 1-10 on what the severity of that injury would be. Values are assessed with one being the lowest likelihood or severity level and ten being the highest likelihood or severity level. The value of likelihood is then added to the value of severity, and the total number establishes the priority level for which process to work on first.

For example, a company uses a chemical process that contains a high concentration of hydrochloric acid. If the process is relatively automated, there would be a low likelihood of a spill that may injure an employee (valuation of 2), but if the spill does happen and an injury occurs the severity (or how bad an injury would be) would be high (valuation of 8). The valuation numbers are added together and the process would be ranked a 10.

The same company also uses compressed air to clean parts. The task is performed with safety glasses and gloves, and is performed in an enclosure that contains any flying particles. Because of the enforcement of protective equipment, the likelihood of an injury is low (valuation of 3) and if an injury were to occur, the severity would probably also be low (valuation of 4). The valuation numbers are added together and the process would be ranked as a 7.

The company also uses a spray booth to paint items. The paint is water based, and has a low toxicity. The spray equipment is old and frequently clogs. It is very heavy and requires employees to have sufficient strength to manage the spray nozzles, and even though procedures say to wear a respirator during the spraying, employees find them uncomfortable and frequently use only dust masks under the face shield when they perform the task. The likelihood of an injury would probably be rated fairly high (valuation of 9), even though the severity of an injury would probably be low (valuation of 2). The valuation numbers are added and the process would be ranked as an 11.

Ranking for the three processes would establish that the priority would be to address the paint spraying operation first, then the hydrochloric acid process, then the compressed air process. It is possible that a process has already been made as safe as practicable. For example, there may not be any additional measures that can be added to the hydrochloric acid process to make it safer, as it is already mostly automated. However, hydrochloric acid may not be the only chemical that can be used to perform in the process and a chemical of lower hazard may be able to be substituted in the process. There are usually alternative chemicals that would increase the safety of a chemical process and decrease the risk, although they may not be as fast working, easy to use or as inexpensive as the higher hazard chemical.

All the alternatives to the existing process need to be considered and evaluated to determine first if they are possible, and second if they are practical.

Four Square Method:

Another simple method is the “four square” method. This method assesses a valuation of risk and likelihood as either high or low. The values are placed in a quadrant, depending upon the likelihood and severity assessment.

		Severity	
		LOW	HIGH
Likelihood	HIGH		
	LOW		

For example, consider the three scenarios from the relative valuation method. The company uses a chemical process that contains a high concentration of hydrochloric acid. If the process is relatively automated, there would be a low likelihood of a spill that may injure an employee, but if the spill does happen and an injury occurs the severity (or how bad an injury would be) would be high. The valuation of the risk is considered low-high, and the item is placed in the lower right quadrant.

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These three processes would be placed in their quadrants and look like this:

		Severity	
		LOW	HIGH
Likelihood	HIGH	Paint spraying	
	LOW	Air cleaning	Hydrochloric Acid

Any process that has a high likelihood and high severity should be addressed immediately and safety features need to be implemented to protect workers.

Depending upon hierarchy of protective measures already in place for a task or process (engineering, administrative, or protective equipment) items with a high severity and low likelihood or items with a low likelihood and high severity should be addressed next. For example, the hydrochloric acid example has several engineering redundancies built into the equipment to protect employees. It has splash guarding, secondary containment and sensors built in. However, the paint spraying process relies on personal protective equipment to keep the likelihood of injury down. Therefore, because protective equipment is less favorable to use than an engineering or equipment design solution, the paint spraying operation would be addressed before the hydrochloric acid process.

The air cleaning process would be addressed as the lowest priority of the three scenarios, because there is a low likelihood of injury (even though it relies heavily on protective equipment) and the process has a low severity rating if an injury were to occur.

DETERMINING COSTS AND BENEFITS

Most of the methods used in determining costs and benefits are fairly obvious. For example, if a company has a coffee maker, and water is needed for making coffee but is not available in the immediate vicinity of the coffee maker, there are several options (some of which are more cost-effective, but less safe, and others that are more safe, but less cost-effective). The company, rather than transport water to the machine, may wish to create a direct water line to the coffee maker. This is more expensive than walking the water from the source to the coffee maker, but less safe in that you have the potential for a slip/trip, spill or breakage of the carafe. Another option would be to move the coffee maker closer to the water source. This may be an option, but one would have to look at the possibility of re-wiring electrical outlets as a GFCI (because it is close to a water source) and the fact that it may be inconvenient for workers to go farther to get their coffee. The third option, and probably most cost effective would be to transport water to the existing coffee maker in a plastic container with a lid. An empty gallon milk jug works very well and is a very inexpensive option, it is not heavy and the potential for a spill is significantly reduced.

Not every example is that simple, however. Frequently there are significant machine or workplace modifications that may need to be made. For example, there is a noisy area where noise levels are over 85 dBA. This level of noise requires hearing protection and a noise program. Such a program can have high administrative costs. Companies would need to monitor noise levels, implement hearing testing for employees, purchasing appropriate hearing protection, train employees, restrict entrance and work in the area, put up noise barriers, etc. However, there may be benefits to such a program such as not having to buy new equipment. The alternative to a hearing protection program would be the option to purchase different or newer machines that are quieter. Capital investment in a new machine, installation, new training, etc., could be costly. However, there may be

benefits to installing new machines such as tax incentives, increase in productivity, employee comfort, potentially reduced maintenance costs, etc. Companies need to look at all the costs and all the benefits of all their options and determine which options are best, and which ones can be implemented for the least cost.

WHY USE A COST BENEFIT ANALYSIS?

Although no job or task is without some element of risk, most can be performed with a high degree of safety. Protective measures (guards, equipment, PPE, and other controls) can be addressed in an effective manner so that the risk of injury is significantly reduced. A cost-benefit analysis can assist in determining the most effective method to address safety concerns and the priorities for the activities require them, in the least expensive manner.

Cost Benefit Analyses, when used in conjunction with other tools, like a Job Hazard Analysis, can outline various options or approaches to making a task safer for the least cost. The Job Hazard Analysis assists in determining where the hazards of an activity are, and potential solutions to reducing or eliminating the identified hazards. Then a cost-benefit analysis can be used to determine which of the identified solutions would bring the best safety improvements, and which options have the lowest expense.