

# Machine Safeguarding Design Considerations

Department: Chemical and General Safety

Program: Machine Safeguarding

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Effective equipment design should allow appropriate safeguarding of points of operation and danger zones to protect employees from injury while maintaining the highest level of productivity with the machine. Consult federal OSHA, ANSI, and NFPA standards for initial guidance. A uniform process should be applied and used to evaluate each of the hazards on the machine to accurately develop the required level of safeguarding.<sup>1</sup>

No standard offers complete guarding requirements for every possible machine configuration. Therefore each machine should be evaluated by a knowledgeable, trained person and compared to the appropriate machine safeguarding standard. This person may use the federal OSHA Machine Guarding Checklist as a non-exhaustive evaluation guide.<sup>2</sup>

The OSHA/ANSI hierarchy for controlling machine hazards is as follows:

1. Eliminate the hazard by design
2. Control the hazard by guarding
3. Warnings
4. Personal protective equipment
5. Training

The standards agree that the first step to safeguarding must be to attempt to eliminate the hazard completely. To eliminate the hazard totally or enclose the exposure on a machine such that the employee has almost zero exposure may not be practical. However, it can be approached very closely to minimize employee exposure to injury.

The second step in determining what level of protection is necessary is often driven by specific regulatory requirements and hazard identification. OSHA regulations point to the need to reduce, through the use of physical safeguarding, the employee's exposure to the identified hazards. This approach is where safeguarding may be applied through proven concepts and designs such as distance and time, barriers, interlocked guards, presence sensing devices such as light curtains, enclosures, and various other guarding combinations.

Once hazards have been identified and prioritized, the third step is to determine what level of protection is necessary. Perform a risk assessment, an evaluation procedure to verify the level of safeguarding needed. In simple terms, there are only two significant

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1 Content based on Scientific Technologies, Inc. engineering design catalog article by Joseph R. Snopek, CSP, PE

2 [http://www.osha.gov/Publications/Mach\\_SafeGuard/checklist.html](http://www.osha.gov/Publications/Mach_SafeGuard/checklist.html)

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factors that must be considered when evaluating the associated risk in a danger zone or at a point of operation:

1. The severity of foreseeable injuries which could occur at a location. The severity of possible injury can vary tremendously from minor cuts to fatality. Most injuries happen immediately but some injuries are chronic in nature and may not manifest themselves until years later.
2. The probability of injuries occurring while the employee is working with the machine. The following should be considered in the evaluation of injury probability:
  1. Machine operation, all phases (operating and maintenance, including set-up, start-up, service adjustments, lubrication, clearing jams or malfunctions, loading and unloading, cleaning, shutting down, preventive maintenance)
  2. Foreseeable misuse of the machinery and equipment
  3. Evaluating human response to determine the frequency of exposure to danger points

One thing that should be clearly understood is that the absence of an injury from a particular exposure or hazard should not be taken to mean that the injury will never occur or the machine is completely safe. Accidents occur more or less randomly and usually result in pain and suffering in addition to the loss of productivity.

Some of the issues to address when determining the potential degree of injury are as follows:

1. What types of physical or mechanical hazards are involved?
2. What types of injuries can be foreseen?
3. Given the conditions under which access to the danger zone or point of operation occurs, what is the probability of each possible severity of injury?
4. What potential loss to the employee as well as to production does each possible severity of injury represent?

Once the risk is accurately assessed, the level and type of safeguarding can be identified and applied to the machine.