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Technical Bulletin

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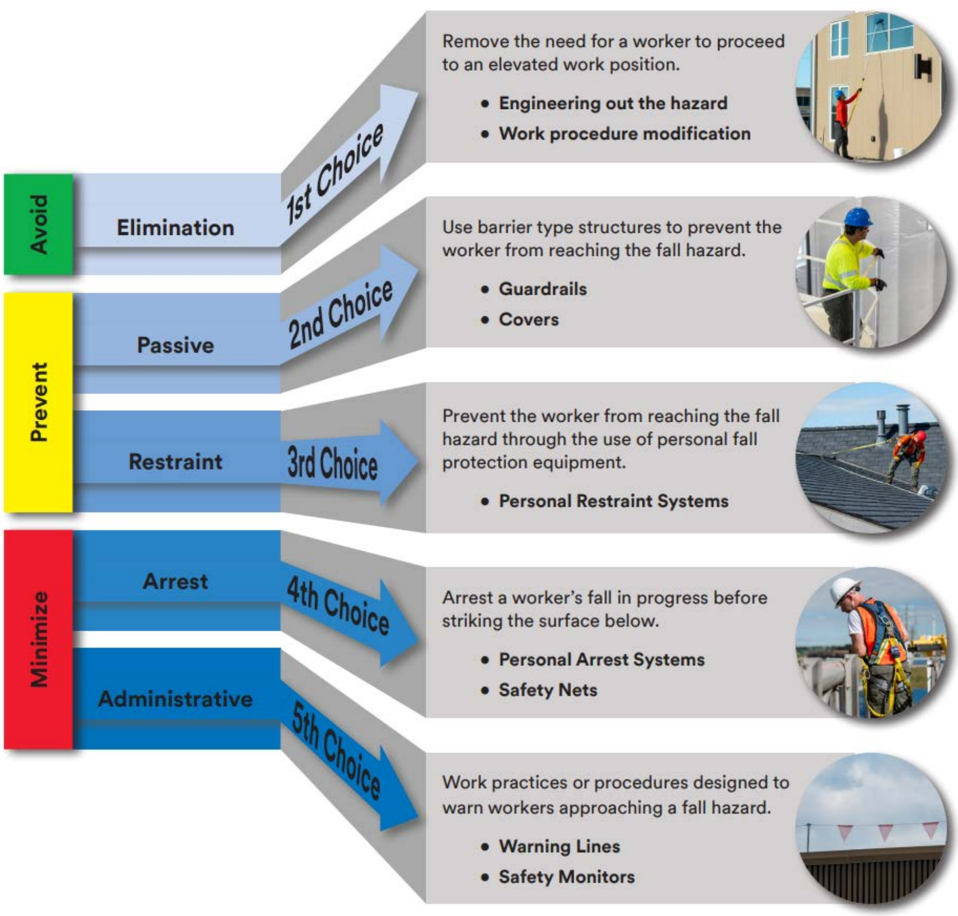
Hierarchy of Controls in Fall Protection

Description

There are many methods of protecting occupational workers as they conduct elevated work. Fall protection was introduced to the industry in the early to mid-twentieth century to decrease worker fatalities on construction sites (Shepard, 2022). Rudimentary forms of PPE, such as a body belt, or passive forms of control, such as a safety net, were used to prevent falls or catch falling workers (Wagner, 2021). As industrial standards and regulations improved and with OSHA taking effect in 1971, the rate of U.S. workplace fatalities began to drop drastically (Wagner, 2021). Latest data, however, shows that that number has plateaued and remains stagnant around 5,000 workplace fatalities per year (Bureau of Labor Statistics, 2023). Perhaps it is time to re-evaluate the effectiveness of current fall protection methods and identify strategies to further reduce fall-related injuries and fatalities in the workplace.

A hierarchy of controls can be a useful tool to select methods of protection that may actually help to decrease risk for the worker. Methods of control can be categorized as follows, in order of most to least preferred: elimination of fall hazards, passive controls, fall restraint, fall arrest and administrative controls. In practice, however, fall restraint and fall arrest are often more popular than elimination and passive protection. This bulletin will explore the current state of the fall protection hierarchy of controls, limitations to its success in practice and what it will take to get to the next phase or iteration of this hierarchy to improve occupational worker safety.

The current hierarchy of controls as it pertains to fall protection is pictured below. The five choices in the hierarchy can be grouped into three categories: avoid, prevent, and minimize. "Avoid" refers to elimination and is the preferred choice. "Prevent" refers to passive protection and fall restraint. The final category is to "Minimize", which refers to fall arrest and administrative controls.



A best practice for fall protection is elimination of hazards. Elimination can be achieved by "engineering out" the hazard or modifying the work procedure. For example, instead of servicing equipment at heights, the possibility of bringing equipment down to the floor level could be explored. This would reduce the time a worker is exposed to working at height hazards. Another example is using a tool extension to clean windows or change light bulbs from the ground level instead of using a ladder or rope grab system.

Often, elimination is not always possible in the field. Therefore, the second choice in the hierarchy is passive protection which refers to barrier type structures that prevent the worker from reaching the fall hazard. This can be accomplished at the design stage of a structure through maintenance conscious engineering such as building a wall around the roof to accommodate maintenance activities. The most common example of passive fall protection is to use guardrails around edges or covers around fall hazards such as skylights and roof access openings.

The third choice in the hierarchy is restraint, which prevents the worker from reaching the fall hazard through use of a personal fall restraint system. The user would wear a harness or body belt and tie themselves off using a fixed or adjustable length lanyard to an anchor point. The length of the lanyard would be adjusted to prevent the worker from reaching the edge of the working surface.

In some industries, prevention is not practical. Therefore, the final two choices on the hierarchy are to minimize the consequences in the event of a fall. The fourth choice is fall arrest. In the event of a fall, PPE helps to prevent the worker from striking the surface below. This can be accomplished using a harness with a personal energy absorbing device connected to an anchor point.

Finally, the last layer of control in the hierarchy is administrative controls. This includes procedures and work practices that warn workers when they are approaching a fall hazard. This method is least preferred because it relies on a worker having a continuous and comprehensive awareness of fall hazards in their work area.

The main limitation to the current state of this hierarchy is the heavy reliance on administrative controls as choices 3 (restraint), 4 (arrest) and 5 (administrative) all depend on a worker properly setting up the fall protection systems. The only two engineering controls in this hierarchy are choices 1 (elimination) and 2 (passive), where the safeguard is designed into the system and is less likely to be defeated by user error. In "A Fall Prevention & Protection Paradigm Shift" (Duren et al., 2023) the authors explore the idea that PPE-based fall protection is relied upon too heavily in industry. They make the argument that to improve work at height safety, industry must shift away from harness-based systems by emphasizing prevention through design.

One contributing factor to the over-reliance on PPE is the lack of regulation that incentivizes industry to eliminate the need for PPE-based fall protection. Some regions of the world, such as the United Kingdom, have significantly higher penalties for fall-related injuries and fatalities, and have lower rates of injury and fatality (Duren et al., 2023). Advancements in science and technology could also help shift the industry towards elimination and passive protection. This could potentially create a new iteration of the hierarchy of controls as maintenance conscious engineering becomes the standard practice in industry. Many wind turbines, telecom towers and hydro poles were built in an era when industry was not as regulated as it is today, and technology was not available to pursue passive protection in a cost-effective manner.
As technology and regulations advance, this may improve the economics of choosing passive methods of fall protection. Eventually, technological advancements, changes in regulations, societal acceptance and improved economics will drive change with the landscape of industry and move the market towards passive fall protection. This will initiate a change in structure of the hierarchy of controls, creating a new iteration for the future. Until then, the hierarchy of controls, as presented, is a tool that can be used to help employers and employees decide which method of fall prevention and protection is best for an application. As safety professionals, one of our key goals should be to constantly advocate for robust methods of protection and training to keep workers safe.

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