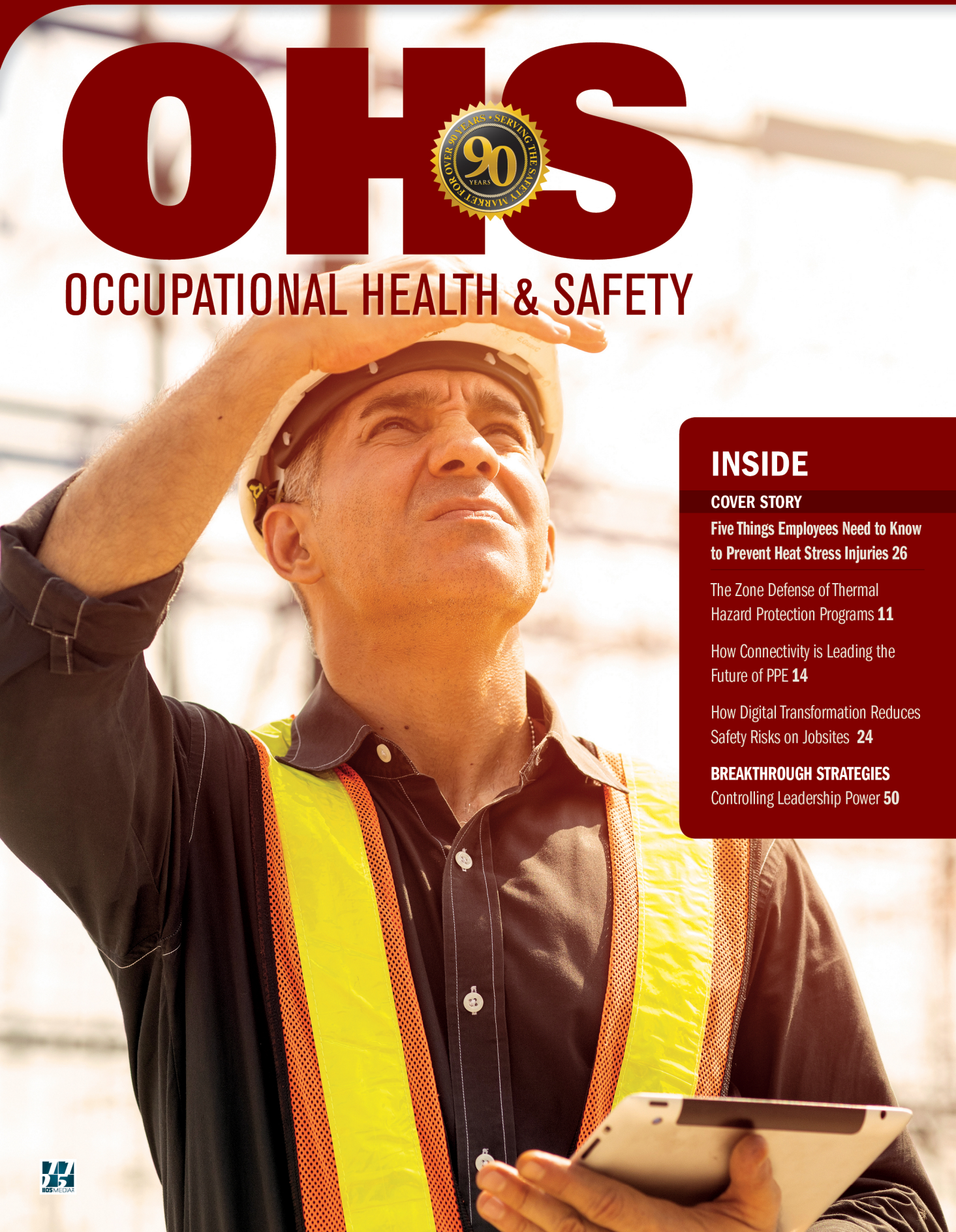
www.ohsonline.com MARCH 2022 | VOL. 91 NO. 2

OHS

OCCUPATIONAL HEALTH & SAFETY



INSIDE

Machine Guarding Best Practices

Determining which best practices your organization can manage will determine skillset gaps and outside support selection criteria.

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Machine guarding is in the OSHA Top 10 Most Frequently Cited Violations each year. Perhaps your organization had a significant machine injury, maybe you have machine guarding risk concerns at your site(s), or you simply feel your organization's culture needs to move towards engineered solutions on the Hierarchy of Controls. Where do you start? We have compiled machine guarding best practices into three categories: Data Gathering, Assessments and Solutions.

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Data Gathering

Data gathering is important as it sets the tone for the entire machine guarding assessment process. Most organizations defer to their Computerized Maintenance Management System (CMMS) for a detailed machine asset list. A CMMS is a software package that maintains a computer database of information about an organization's maintenance assets, including a detailed machinery list. It is recommended to do a validity check and make sure that all obsolete equipment is removed, and newer equipment is on the list. It would also be recommended that the list includes the asset name, asset number, description and location as these would assist in work scope execution.

For those that are managing multiple sites, there will be additional steps to the process. Locations could vary in size and not have a CMMS system; in which, you may need to defer to the accounting asset list. For each location, it is recommended that the location name, location point of contact (as well as their contact information), city, state, country, number of buildings, number of assets and approximate square footage of the facility be noted.

Now that the data is gathered, you should determine the expected work scope and output of this initiative. Do you need a risk assessment? Would you like a guarding inventory? Will the assessment be per OSHA or ANSI standard? Do you want to capture best practices during the process? Once these considerations are clear, you will need to determine if this is an internal initiative or if external support is required.

To determine if this can be executed with internal labor, it would be important to calculate the expected workload in hours. Based on our experience, you can assess approximately 25 machines per day in a manual assessment process, which will then take approximately 10 days to organize notes and images into a usable standardized reporting format.

Internal Labor Calculation (ILC): Estimated Working Days = (Total number of machines/25) + (Total number of machines/25 x 10).

Example for a location with 450 machines: (450/25) + (450/25 x 10) = 198 working days.

With 200 working days in a year, this would be a full-time job. This is perhaps the biggest mistake we see when undergoing these initiatives internally. The amount of assessment time is underestimated and when distractions occur, details are missed and/or it becomes a lost initiative. At this point, you may want to consider outside services.

There are machine guarding assessment companies that have developed internal software to increase the number of machines inspected and eliminate the data documentation time. Thus, comparing it to a manual process, it will significantly reduce time to implementation and your overall project costs.

With these thoughts in mind, it is now time to establish the team. Establishing duties and responsibilities for the site point of contacts and support team is recommended. This team should be brought in to discuss and develop the startup processes and project timeline. To develop an impactful team, the members equipment experience and knowledge of the machine guarding standards are important. Team alignment on how risk will be assigned to each machine component must be standardized.

We see many organizations start the assessment process but never get to the solutions. Mostly because they overlook the estimated costs of this endeavor. What is this initiative going to cost? For a general rule of thumb, we recommend using $2,500 per day of assessment labor and per machine solution.

Machine Guarding Improvement Budget (MGIB): MGIB = (number of assessment days x $2,500) + (number of machines x $2,500).

Using the example from earlier of 450 machines at a rate of 25 assessments per day: (450/25) x $2,500) + (450 x $2,500) = $1,170,000.

Why is this important to know up front? Because too many organizations start this initiative and don't anticipate the total costs. Thus, we recommend performing a quantitative risk assessment with the machine guarding assessment. During this assessment we also recommend coming up with estimated budgetary solutions. Your leadership's primary language is typically data and financially driven. Understanding financial diminishing returns is necessary to successfully present and obtain budget approval.

Assessments

Once the data gathering is complete, you can begin the machine

> *A critical success factor of a machine guarding improvement initiative is understanding the details within these processes.*

guarding assessment. A robust documentation process must be developed so the assessment team can consistently capture machine component details, photos, and document the associated risks. Communicate the assessment schedule to department leaders, machine operators, and maintenance. Their input on the machine's functional scenarios will be required as well.

The objectives of an assessment should include identifying equipment specific machinery hazards, perform a risk ranking utilize Six Sigma PFMEA or equivalent, develop a solution implementation plan based on risk, budgetary recommendations, and develop a current state machine guarding inventory.

Our first objective is to identify the equipment specific machinery hazards. To begin this, talk with the operator(s) of the machine and make sure you fully understand how they interact with the machine. Next, question them about the various machine set ups and conditions. How are parts loaded into the machine? How long does a cycle last? How often are you loading/unloading parts and making set up changes? Take note of what exactly is happening during the process. Are scrap chips or dust a result of the process? Is there coolant or high temperatures involved? What are the maintenance requirements of the machine? Is the operator aware of any historical injuries or near misses involved with this machine? Are existing safeguarding systems in place, and do they restrict the operator from performing routine tasks? If the equipment is operating and guards are not being used, question the operator as to why. Asking these questions will go a long way to ensure you provide an accurate assessment that will help down the road when considering solutions.

Once you completely understand the equipment, process and operator notes, you need to document the hazardous components of the machine. This is where you put your machine guarding knowledge to work. Identify any machinery hazards such as point of operation hazards, ingoing nip areas, power transmission hazards, rotating parts, cutting blades, flying debris and splash hazards, etc. Photos should be acquired of each and filed with the individual hazard components of the machine. These photos will be helpful when it comes to identifying solutions and determining budgetary estimates. Hazard documentation applies to every machine component hazard whether guarded at the time of the assessment or not.

Once you have confirmed and documented the machine components and related hazards, you must assign the risk priority number using a quantitative methodology to rank the relative risk of each component. A simple method of assigning risk is looking at three variables associated with incident potential: severity, frequency, and controls. For each machinery hazard assign a value (1 to 5) for each risk factor. Generally, assume the worst-case injury scenario when assigning values to the risk factors.

Solutions

Now that the machine guarding assessment is complete, the team needs to determine the most cost-effective OSHA compliant solution. This part of the machine guarding improvement process can be difficult. It is difficult because team member's personalities can hinder the final decision-making process. This can be improved with a design facilitation.

Every team member will have their opinion of potential solutions. Facilitation of compliance versus operator and maintenance usability is critical to success. Facilitating a process where opinions are heard, but logical OSHA/ANSI compliant designs are adhered to. More organizations have operational excellence departments, so it is wise to have them facilitate this process. If you don't have this change management skillset, it may be best to have a third party involved. Either way it is recommended that your team is involved in the solution designs. There are pros and cons to many different solutions, but design decision criteria should be outlined around compliance. To do this, we have found that standardizing design decisions into a decision tree eliminates opinions, creates alignment and focuses the team on rapid results.

With a process driven decision-making tool, you can focus on cost effective solutions. Implementation is now driven by product applications, machine system integrations, and installation. These are typically a combination of electro-mechanical solutions. If your internal sources are busy or there are gaps in desired skillsets, then working with a third party may be beneficial. Working with a third party that understands OSHA/ANSI machine guarding standards, has the mechanical abilities to design for installation, and the electronic and electrical requirements to successfully integrate a custom system is recommended.

As solutions are executed, consider the required post assessment actions. Some of these actions may include operator, maintenance, and supervision training. If the team couldn't agree to a fully engineered mistake proof solution, routine inspections of guarding may need to occur. Thus, updating the CMMS with the guarding inventory list and possible preventive maintenance inspections may be necessary. Developing a process for updated equipment acquisitions, modifications, or decommissions equipment should be completed. The post assessment considerations would ensure a systemic plan-do-check-act and improve the sustainability of this initiative.

In conclusion, executing the outlined machine guarding best practices will reduce your organizations risks, time to solutions and implementation costs. Determining which best practices your organization can manage will determine skillset gaps and outside support selection criteria. A critical success factor of a machine guarding improvement initiative is understanding the details within these processes. OHS

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MACHINE GUARDING ASSESSMENTS

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