SAFETY FIRST - PUTTING UP YOUR GUARD

A Case Study – How One Global Consumer Products Manufacturer Addressed Machine Safety

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Introduction

In the time that the Occupational Safety and Health Act (OSH Act) became effective on April 28, 1971, workplace deaths and reported occupational injuries dropped more than 60 percent. However, as of January 2012, OSHA reports that the United States still faces an unacceptable and preventable number of work-related deaths, injuries, and illnesses. Every day, more than 12 workers die on the job – over 4,500 a year and more than 4.1 million workers suffer a serious job-related injury or illness. A renewed focus on prevention is needed to bring these numbers down.

To accomplish this, the occupational safety and health community has developed and initiated systematic approaches to reduce injuries and illness in the workplace.

Regardless of the title of the various company programs, all address workplace safety and health hazards on an ongoing basis to reduce the extent and severity of work-related injuries and illnesses. These programs help employers find hazards and fix them before injuries, illnesses, or deaths occur. They also help employers meet their obligation under the OSH Act to “furnish to each of its employees, a place of employment which is free from recognized hazards that are causing or are likely to cause death or serious physical harm to its employees.”

Source: OSHA Injury and Illness Prevention Programs White Paper, January 2012
While Return on Investment is not the focus, such programs help employers avoid the significant costs associated with injuries and illnesses in the workplace. Even though costs related to injury and illness certainly impact companies, Aberdeen Group’s research finds that the Top Four pressures driving Best-in-Class companies are: Need to be in Compliance (64%); Reduce the number of safety injuries/incidents (49%); Reduce the risk of an adverse event (22%); and Corporate sustainability mandates (18%). Source: Integrated Safety Systems Ensuring Safety and Operational Performance, November 2011

**POLYTRON CASE STUDY: PUTTING UP YOUR GUARD**

In 2009, one of the leading global consumer products manufacturers launched a new fatality elimination campaign as a part of its existing EHS Management System. The stated safety goal is zero workplace fatalities by 2015. Source: Company 2011 Sustainability report

The overall safety brand was implemented as a strategy to drive cultural change and includes employees, contractors, and visitors. To create a fatality free and incident free workplace, the strategy applied a two-way commitment: The company committed to providing a workplace that is compliant with all applicable laws and regulations and individuals are expected to refuse to take part in any action considered unsafe, confront others acting in an unsafe manner and immediately stop any unsafe actions.

Key Performance Indicators for the company’s manufacturing facilities were established and defined in the following areas:

- **Total Reportable Incident Rate**: Work-related events that result in fatalities, temporary or permanently disabling injuries or illnesses per 200,000 hours worked per annum.
- **Lost Time Reportable Incident Rate**: Reportable injuries/illnesses that result in time away from work or restricted work per 200,000 hours worked per annum.
- **Global Contact with Energized Equipment Incident Rate**: Cases resulting from bodily contact with energized equipment (electrical, mechanical, hydraulic, gravity, radiation, pneumatic, thermal, etc.) per 200,000 hours worked per annum. These include incidents arising from inadequate guarding of equipment or machine, or failure to follow energy control work practices, etc.

Direct cost of the most disabling workplace injuries in 2008 was reported to be $53 billion (Liberty Mutual Research Institute, 2010).

And, in 2011, The National Academy of Social Insurance (NASI) estimated that $58 billion in annual workers’ compensation benefits was paid for all compensable injuries and illnesses during 2009.

Injury and illness prevention programs are not new, nor are they untested. Most large companies whose safety and health achievements have been recognized through government or industry awards cite their use of injury and illness prevention programs as their key to success.

Convinced of the value, effectiveness, and feasibility of these programs, many countries around the world now require employers to implement and maintain them. These countries include Canada, Australia, the 27 European Union member states, Norway, Hong Kong, Japan and Korea. This initiative also follows the lead of 15 U.S. states that have already implemented regulations requiring such programs. (Source: OSHA.gov -2012)

Improving our safety record is not only good for our employees – it’s good for our business. We have calculated that progress in lost-time cases and days lost saves the Company approximately $30 million in direct costs each year.

Ford Motor Company 2010-2011 Sustainability Report
Our case study company took action in the following areas as the program was implemented:

- **Culture Change** – Training sessions for all employees at the company’s global manufacturing facilities.

- **Facility OS&H Leader Qualification and Competency Standards** – Standard minimum qualifications and competency requirements for senior facility OS&H leaders.

- **Machine Safety Standards** – Risk-based approach to safeguarding selection to provide flexibility in safeguarding method(s) in compliance with international consensus standards, ISO 14001 and OHSAS 18001.

- **Plan-Do-Check-Adjust Methodology** – Policy and Organization, Planning, Implementation and Operation, Checking and Corrective Action, and Management Review.

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**PLAN – DO – CHECK – ADJUST (PDCA)**

PDCA, a common methodology that is also applied in manufacturing programs, was made popular by Dr. W. Edwards Deming, considered to be the father of modern quality control. The steps in each successive PDCA cycle, and the traditional responsibility are:

**PLAN** – establish the objectives and processes necessary to deliver results in accordance with the expected output (the target or goals).

**DO** – implement the plan, execute the process, and make the changes. Collect data for charting and analysis in the following “CHECK” and “ADJUST” steps.

**CHECK** – study the actual results (measured and collected in “DO” above) and compare against the expected results (targets or goals from the “PLAN”) to ascertain any differences. Information is what you need for the next step “ADJUST”.

**ADJUST** – request corrective actions on significant differences between actual and planned results. Analyze the differences to determine root causes. Determine where to apply changes that will include improvement of the process or product. When a pass through these four steps does not result in the need to improve, the scope to which PDCA is applied may be refined to plan and improve with more detail in the next iteration of the cycle, or attention needs to be placed in a different stage of the process.
At-Risk Equipment

When our client launched its 2009 zero-fatality program, there existed company manufacturing facilities with equipment that required updating to meet new Occupational and Machine Safety standards. Additionally, multiple OEM safety systems existed, therefore the implementation of safety standards was inconsistent.

As part of its strategic plan, the company partnered with preferred vendors to assist with a company-wide risk mitigation of its equipment.

- The client’s dedicated safety team developed Standards of Safety for all equipment which included: Conforming to Safety Categories based on the risk assessment, maintenance standards, operational consistency, and troubleshooting procedures.
- Preferred vendors, such as Polytron and E&M, were selected to support the safety initiatives. Selection was made based on vendor’s critical understanding of how the risk assessment translates into applied machine safety systems to lower the risk score.

- Training meetings were held with preferred vendors, key technology suppliers and OEMs to share the new standards and requirements to support the machine safety initiative. Those trained were then brought alongside the Safety Team to provide support in the risk mitigation effort.

Risk Mitigation for Older Equipment

Machine safety modifications are typically conducted in one of two ways. With new equipment, the modifications are designed into the equipment and for older equipment, either in-depth modifications are required to the controls or modifications are added onto the equipment.

Based on the new safety standards, the Safety Team began the risk assessments for existing equipment to identify the greatest risks that required mitigation. Polytron along with other strategic technology partners provided support for the risk assessments.

Polytron's Approach to a Successful Machine Safety Project

Identification

1. Company conducts equipment risk assessment, identifies hazards and assigns a risk score to each hazard.
2. Polytron team reviews company risk assessment created for equipment and identifies options to address certain hazards.

Definition

1. Polytron defines modifications required and develops a functional specification describing those changes.
2. Polytron develops scope, cost, and schedule of requirements to implement the changes.
3. Company includes needed modifications in costs for capital projects, if identified for Capital Request.

Execution

1. Polytron executes project and implements modifications identified in approved design.
2. Company and Polytron partner to validate that system conforms to requirements as defined in functional specification.
3. Polytron conducts training for company workforce: Ops, Maintenance, Engineering – to educate on machine safety updates and additions.
Some of the OEMs, who originally provided the older equipment, were contacted to assist in the safety modifications. What Polytron found was that due to the extensive changes to be made to the equipment, it would be cost prohibitive to use the original OEM.

Oftentimes, the OEM needed the equipment shipped back to their facility to perform the upgrades – an alternative that would not be considered due to the increased loss of production and costs. The manufacturer decided the best option was to engage Polytron and its partner E2M to execute the more engineering-intensive machine safety upgrades for older equipment, some of which was 20+ years old.

Older equipment presents more complex issues, such as legacy control architectures that can’t support new safety technology, outdated utilities, and the constraints of other systems that interface with the equipment.

These factors challenge the project team to understand and define the full scope and scale of what is needed. Definition is difficult due to the unknowns that will likely be uncovered as the project begins. It is extremely important to have a thorough plan identifying all possible contingencies in each area prior to beginning the work.

Machine safety projects are more successful when a systems integrator with machine safety expertise is involved. This expertise allows the manufacturer to realize benefits such as:

- Understanding of standards and how to effectively apply technology.
- Minimized machine downtime and impacted systems due to a well-developed plan.
- Cost-effective changes that reduce the risk level of the equipment within company allowable limits.
- Increased equipment efficiency in most cases.

Machine Safety upgrades offer an opportunity to address operational efficiency as the safety project requires a complete overhaul of older equipment. While our client did not use the project to increase efficiency, the safety initiative did result in some improvement.

This is effectively measured in reduced Mean-Time-To-Repair (MTTR). Since the equipment now has isolated safety / operational zones, repairs to the equipment or clearing faults can be accomplished in the affected zone without impacting the operation of the rest of the machine.
Risk Assessment and Risk Mitigation – A Consultant’s View

A Risk Assessment should be viewed as a living document that changes constantly. It must be continuously reviewed to understand and apply all of the mitigation techniques available for each identified hazard. J.B. Titus, of JB Titus and Associates, points out that after completing the risk assessment, the five levels of hazard mitigation described in machine guarding standards are:

1. Eliminate the hazard – design it out
2. Isolate the hazard with hard guarding
3. Add additional engineering, guards, devices or layers of safety (controls or systems)
4. Apply administrative controls like training, signage, etc.
5. Require Personal Protective Equipment (PPE) like goggles, gloves, outer clothing, shields, etc.

All five levels are fully acceptable risk mitigation solutions to achieve that “acceptable” level of mitigated risk. J.B. Titus is of the opinion that “acceptable level of risk” for a given hazard is intentionally left undefined because the company is the one who defines the tolerable level of risk the company is willing to accept. Documentation of the complete process for each identified hazard, which includes the steps of mitigation taken to achieve that “acceptable” level of mitigated risk, puts the company in the best position of compliance, if it consistently meets OSHA’s requirements for employee training and documentation. (Source: Machine Safety: Is OSHA okay with my ‘acceptable’ risk mitigation, J.B. Titus, July 12, 2012, Blog – Control Engineering)

JB Titus and Associates portrays the Risk Reduction process depicting the tolerable risk scenario most typically followed to determine if the risk is acceptable or requires some action for risk mitigation.

In our case study, a risk assessment was conducted for impacted equipment. The Safety Team reviewed and assigned risk values which become the “triggers” for corrective action.

“Process” becomes quantitative

Produced with the Permission of JB Titus and Associates
High Risk Palletizer Area

In our case study, risk assessments targeted the palletizer area as a higher risk area for a standalone safety project. Polytron conducted the project in collaboration with its partner E’M. Consistent with Polytron’s machine safety mitigation approach, Polytron and E’M began to conduct the remediation process on the equipment in the palletizer area based on the company’s risk assessment.

The team reviewed the risk assessment provided and began the task of identifying the modifications to lower the risk level of each hazard to bring it within the company’s stated range of tolerance.

A functional specification was developed by Polytron and E’M addressing the specific areas identified in the risk assessment and presented the recommended modifications to the customer. The goal in the functional specification was not only to adjust and modify to lower the risk level on each area, but equally important, to ensure that changes did not inhibit operation of the machine. The modifications also provided a consistent system with machine safety engineering and standardized automation - reducing downtime and increasing availability to diagnostics.

The Polytron and E’M team reviewed the design, plan, and cost for the entire project and upon approval from the manufacturer began the work.

Implementing the Project

Scheduling the implementation of the machine safety project requires extensive coordination due to the evident downtime of the equipment. Older equipment requires considerable updating to bring into compliance and can incur as much as two to four weeks downtime based on the complexity of the project.

In our experience with machine safety mitigation, it is a tradeoff between the cost of new panels and components versus lost time in production to modify existing controls. In this case, our client was fortunate to have parallel systems that provided alternative routing for the line to minimize the impact on production. In most cases, the equipment safety upgrade project impacts the entire line with unavoidable downtime.

The total project included:

- Applying standard controls software components, provided by the customer, including state machine and PLC program templates, and standard HMI faceplates
- Adding technology as an enabler: Safety-rated components such as safety PLCs, contactors, switches (interlocks), VFDs, light curtains, door switches, E-Stop push buttons, and safety rated sensors
- Creating isolated safety zones to more efficiently operate and maintain equipment

Equipment updates and modifications were completed and validation and start-up was coordinated with our client. Validation of the technology and physical machine guarding was checked and verified for machine safety compliance, and risk mitigation was finalized in documentation.

Climate Change – Critical Training

Risk mitigation creates necessary change for everyone’s protection and in many cases, provides operational improvement. For operators, a machine that has been upgraded with new safety features should be approached as new equipment – machine operations and maintenance has changed, the HMI is new, the logic is different, and new technology has been added. The updates create the need for training and documentation to ensure safety upgrades deliver the intended outcome.

As a result of the changes made to the equipment for our client, new manuals were generated outlining new safety procedures and changes in operator tasks. Polytron’s training team conducted specialized safety training for the updated equipment. For instance, procedures for isolating hazards within a safety zone changed. Isolated safety zones enable the operator to stop the impacted area, access the jam and remove blockage, and restart the isolated zone.

Without training, the operator would continue to shutdown the equipment as before, creating unnecessary downtime. Technology Transfer and Training is critical to the success of risk mitigation projects, and most importantly for continuity of performance and increased safety of operations.
Palletizer Machine Safety Upgrade a Success

Equipment risk levels in the palletizer area were reduced to an acceptable level. This required applying guarding, new software, safety-rated components and technology, and creating isolated safety zones for efficient operation and maintenance.

Training was conducted on the new machine operation. As a result, the workforce has integrated the new safety procedures and functionality into the regular maintenance and operation of the system.

This client continues to rely on Polytron and its partner E/M to execute machine safety projects identified in the risk assessment as the company’s EHS program progresses and other upgrades arise based on capital improvements involving targeted equipment.

Based on the company’s 2011 Sustainability report, since the initiation of the machine safety program in 2009, the company has reported zero fatalities in 2010 and 2011.

Other successes reported: 69% of the major findings from the global assessments have been closed; 95% of the corrective action and preventative action from fatalities have been closed.