MILLER ENGINEERING SERVICES

Forensic Engineers & Consultants
PO Box 201443
Austin, TX 78720

Failure Analysis
Product/Machine/Electrical Failure
Construction Losses-Laboratory Analysis

Telephone: (512) 401-6377
Email: info@forensicPE.com
Website: www.forensicPE.com

The Forensic P.E.
Spring 2004 ~ Newsletter

In this Issue:

- **Construction Hazard Awareness**
- **Product Safety – Machine Interlocks**
- **OSHA Software – eTools Online**

CONSTRUCTION HAZARDS – Early Identification and Risk Control

The tragedies associated with construction project losses give us the opportunity to reflect on the incident causes. In many cases we can use our hindsight to view the "coulda's", "shoulda's" and "if-only's" that might have made the difference early in the project. As a result of these necessary and sometimes profitable incident reviews, a tool has developed that is in use by many construction agencies. That tool we refer to as a "Hazard Identification Program". It may also be known by other names, but the basic concept is **the early identification and control of construction site hazards**. The purpose for early identification is to facilitate the elimination or control of the hazard risk prior to construction mobilization.

The Hazard Identification Plan (HIP) is simply a checklist tool that the safety professional can use to consistently review projects for the high-frequency, high-risk potential incidents. OSHA has published a document as a part of its "focused inspections" which gives us some idea of the most frequently encountered incidents. The document is located at the OSHA website:

www.osha-slc.gov/Publications/Const_Res_Man/1926_C_inspections.html

By OSHA's records the most frequent hazards that cause 90% of all injuries and fatalities are;

- falls, (e.g., floors, platforms, roofs)
- struck by, (e.g., falling objects, vehicles)
- caught in/between (e.g., cave-ins, unguarded machinery, equipment)
- electrical (e.g., overhead power lines, power tools and cords, outlets, temporary wiring)

1. Identifying the Hazards – This is the first step. It includes walking the project site and meeting with the project and design engineers to get a handle on the scope and activities associated with the project. A well-developed HIP will provide the safety professional with the ability to target his questions and focus his initial investigation into the high-rate hazards.

Typical questions covered by the HIP include;

- What existing hazards exist at or near the site? Power lines? Pipelines? Nearby population & traffic?
- What construction techniques might create hazards? Blasting? Excavations? Heavy lifts? Chemical handling? Steel erection? Hot work? Hot tie-ins?
- What high-risk tasks will be employed?

2. Hazard Elimination or Control - Once the hazards are fully identified, documented and reviewed with the project team, the next step is to review methods to eliminate, control or mitigate each potential risk.

The preference should ALWAYS be to eliminate the hazards. This might be done by re-routing or de-energizing overhead power lines for example. If elimination is not feasible, then the next method would be to ***control the hazards***. Barricades and barriers are potential control methods. An example might be to install overhead power line barriers consisting of non-conducting, pole mounted pennant flagging or fencing with set back distances and heights such that they would preclude cranes or large equipment deliveries from getting into the power lines. Another example might be to protect underground pipelines with post and chain barricades around the pipeline right-of-way.

Controlling methods provide less assurance than **elimination methods** but can provide a high degree of safety by preventing unsafe contact or actions. They can take many forms and are almost always available to the safety professional.

Construction Hazards - continued

If the hazard cannot be eliminated or controlled, the only available next steps are *WARNING and TRAINING* and ***these steps are much more vulnerable to human error !!!***

It is important to not move on until you have reached a consensus on ELIMINATING or CONTROLLING THE HAZARDS. Here is the key to loss prevention. This is where the safety professional or project manager can make a difference.

3. Warnings may consist of caution, warning or danger signs near the hazard or at the location of the risky task. But signs are static and stationary and can be ignored after complacency sets in.

4. The last defense against high risk tasks is task-specific training and procedure controls. Training must be repetitive and focused to be effective. Another consideration should be the implementation of task procedures which require multi-person, documented, step-by-step signatures before proceeding with the next step.

The result of implementing an early Hazard Identification Plan can be a reduction in the project's incident frequency.

PRODUCT SAFETY – With Electrical Interlocks

Electrically controlled equipment always includes some safety features designed to mitigate damage when the unexpected failure occurs. Circuit breakers, fuses, position limit switches, thermal switches and push buttons are some of the components that can form part of the safe design of equipment and machines.

The man-machine interface can be a hazard-rich environment but for the installation of electrical interlocks. These interlocks and the logic control system that is supported by their input, are designed to prevent the inadvertent and possibly hazardous exposure of the human to high impacts, pinch points, cutting, burning or high voltage danger areas.

The most basic of interlocks are simple limit switches based on lever actuation or magnetic pickup. These sensors can give a "go" (affirmative) or "no-go" (negative) signal to the logic control system. The sensors can determine that guards are in place, hands are out of the way, and pinch points are clear. But many control systems are vulnerable to being overridden by the inventive consumer or factory worker.

The demand on the product designer is then to make the product or machine and safety interlock system maintainable, but not defeatable !!!

This requires a close look at the specific man-machine interface and then some creativity in deducing how the machine safety system might be defeated or abused or might cause infrequent injuries through abnormal human interaction. On industrial machines the designer must also consider how the machine can be safely maintained through proper lock-out tag-out procedures.

OSHA SOFTWARE – eTools Online

The OSHA website has a whole host of products freely available on its website for the safety and project construction professional. These include several expert system advisors and eTools to interact with you and your specific project and provide you with a completed report. The report identifies potential hazards (based on your input) and provides related OSHA regulations and safety input. The website address is;

www.osha.gov/dts/osta/oshasoft/

Another useful OSHA site provides technical links for many Safety and Health Topics;

www.osha.gov/SLTC/index.html

About the Author: **Gregory W. Miller, P.E.** is a registered engineer in the State of Texas and has had 30 years of experience in the design and implementation of factory processes, industrial safety, electrical power distribution projects, and safe construction practices. He provides consulting and forensic engineering services to clients nationwide. **Gmiller@forensicPE.com**