To Err is Human.

BUT MAKING A HABIT OF IT WILL COST YOU.

Everyone makes mistakes. Nobody's perfect. We've all heard those or similar words, and if you happen to be in charge of your company's quality efforts, you've probably heard them more than most people. But the hard truth is that mistakes have consequences, and oftentimes they are costly, if not absolutely dangerous—especially in gear manufacture.

An entire industry devoted to reducing human error and shortening lead time and other quality issues in the workplace has grown proportionately with domestic and global competition for winning and retaining customers. Since the days after World War II, when the warring countries returned with a vengeance to making things again for peaceful purposes, formal quality systems such as Lean, Six Sigma and others have played a central role on the factory floor and beyond. Indeed, with all these various systems in place, in increasingly more manufacturing settings, one can reasonably wonder how mistakes are ever made.

And that, of course, is where we humans enter the picture.

Ben Marguglio, president of B.W. (Ben) Marguglio, LLC, has for the past eight years led a series of what he calls High-Technology Seminars, including a seminar on Human Error Prevention. (Other seminars include Problem Reporting; Root Cause Analysis, and Corrective Action; Measurement of Organizational/Process Performance; and Quality and Environmental Auditing in accordance with ISO 19011.) The seminars, presented by Marguglio along with eight other professionals on Marguglio's staff, are what Marguglio refers to as "high value"—i.e., information about processes and techniques "that have been successfully implemented and proven effective in one or more enterprises;" and "high content"—by which attendees "receive essentially all of the information (needed to) successfully implement a process or technique." Last, the seminars are "highly specific" in that participants are provided with "information to the appropriate level of detail necessary to fully understand" a process or technique.

Stipulating that most, if not all, error in manufacturing begins at the human level (e.g., a software program is only as error-proof as the person writing it), this article concentrates on Marguglio's Human Error Prevention seminar.

"I think that almost everything boils down to human error, with the exception of acts of nature," says Marguglio. "We tend to focus, unfortunately, on the last person to touch the process, and in the case studies that I use in my seminars, I demonstrate that many human errors occur upstream.

"Errors occur in the preparation of documents, in the planning for the creation of documents, and many of those errors are latent errors, and the hazards are only activated by what I'll call an initiating error or an initiating action. The person on the line may make an initiating error or take an initiating action, and lo and behold that initiating error or action will activate a hazard that should have been protected against, for which there should have been a barrier or barriers. And the failure to create these barriers constitutes errors upstream."

Marguglio addresses the above with what he calls "four fields of focus," which are:

- Identify hazards and create barriers against these hazards
- Identify error-inducing conditions and either eliminate them if it is possible or economically appropriate, or behave in ways by which to counteract error-inducing conditions, minimizing the probability of error
- Practice thought process and behaviors by which to prevent error, particularly with regard to decision making
- Prevent the recurrence of error

According to Marguglio, the first three fields of focus relate to preventing error, while the last—preventing repeated

continued

errors—recognizes that human error cannot always be prevented.

Inherent to the areas of focus are hazards and barriers—hazards being the minefields of potential error, and barriers serving as the preventive mechanisms put in place by management. Part of what Marguglio teaches is how best to understand and approach his four fields of focus. Much of what Marguglio imparts to client participants is based on the teachings of two significant figures in the world of quality assurance—Dr. Joseph M. Juran and Dr. A. V. Feigenbaum. Both men, says Marguglio, "almost simultaneously came up with the idea of quality of design, but still today, unfortunately, the focus for quality of design is on hardware. One of the things that I've been trying to get people to understand is that quality of design also applies to the design of the administrative process, which governs the design of the hardware; the design of the technical process, which converts the computer design to a physical being. So quality of design can't only apply to hardware; it has to apply to process as well." (Some would say that lean manufacturing, among other systems, when fully implemented, addresses this as well.)

All of this may seem a bit cerebral, but it works. Just ask Hal Finley of Cameco Corporation.

"Having attended two of Ben's courses—Problem Reporting/Root Cause Analysis and Human Error Prevention—I found the course material well researched and presented in a manner that brought out both the underlying theory and practical applications.

"Our company continues to send employees to Ben's courses, and has now contracted him to assist with improvements to our investigation and analysis process."

OK—most of us will admit that human bumbling is at some point a root cause for error. But why is that? Most would probably answer, who knows? But Marguglio believes he has isolated the factors involved. And while it is tempting to refer to them as the seven deadly sins of error commission, Marguglio professionally calls them the seven human error causal factors. He bases this on his review of "literally—and this is not an exaggeration—on hundreds, if not over a thousand problem reports, incident reports, condition reports, etc."

His seven human error causal factors are:

- Knowledge-based error—a basic lack of knowledge of requirements or management expectation, or of a customer need
- Cognition-based error—an inability to understand the requirement, management expectation or need; or inability to apply, analyze, synthesize or evaluate a requirement
- Value- and belief-based error—a lack of respect for or acceptance of the standard, requirement or need
- Error-inducing condition or situation—a lack of recognition of the condition or situation, and/or lack of counteracting behavior
- Reflexive-based error—a lack of thought processes and behavioral techniques for conservative decision making in reacting to an immediate "field stimulus"
- Skill-based error—a lack of dexterity
- Lapse-based error—nothing lacking; simply "blew it"

In Marguglio's view, the most important conclusion ascribed to the above is that an understanding of them is paramount when attempting to identify human error causal factors and when doing root cause analysis.

Looking at these factors should prompt a question regarding training. And while training is certainly important and beneficial, it is not a panacea in Marguglio's world.

"A large part (of human error) is due to improper selection of personnel for a given job and improper training," says Marguglio. "An enterprise has the responsibility to train its employees for those aspects or elements of the job that are unique to the enterprise, but the enterprise is not responsible—and should not have to train—for things that are universally available through the school system."

Whether the "school system" can be counted upon to provide the technical training and expertise needed in today's high-tech world has been discussed in past issues of this magazine and is grist for another day. But aside from that, manufacturers might take some solace from the fact that individuals like Marguglio are out there doing what they can to at least reduce the doh! factor.

(*B. W. [Ben] Marguglio possesses many years of high-technology experience at the executive level. A Fellow of the American Society for Quality (ASQ) since 1974 and an ASQ-certified quality engineer, reliability engineer, manager and auditor, Marguglio has authored dozens of technical and management papers as well as two books*—Quality Systems, *1977, publ. American Society for Testing and Materials, and* Environmental Management Systems, *1991, publ. Marcel Dekker, Inc.*)

For more information:

BW (Ben) Marguglio, LLC
P. O. Box 8
Cold Spring, NY 10516
Phone: (845) 265-0123
ben@HighTechnologySeminars.com
www.HighTechnologySeminars.com