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EDITORIAL

Using Failure Analysis of Near-Misses to Avoid "Two-Peats" and "Three-Peats"

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Failure analysts have an opportunity to prevent "repeat" failures by performing good investigations and then passing on those findings to interested individuals and clients. Failure analyses are often performed for major failures. But what about near misses and precursors to major failures? Are they getting investigated?

A catastrophic or major incident is almost always investigated, but can we say the same for near misses and precursors to major incidents—are they being investigated? Often major failures are not caused by one isolated issue or event; there may be multiple less severe precursors leading up to a major event.

During an investigation, lessons are learned in the investigative process that can help prevent a failure, a repeat, or even a "three-peat." In sports, a "three-peat" (winning three consecutive championships) may be desirable. But, no user or operator or designer of parts wants a "two-peat," let alone a "three-peat," of a hazardous event or failure. To avoid such repeat occurrences, it is important to conduct investigations—even if they just involve precursors and near misses—they may end up being warnings for an impending failure.

A *precursor* can be defined as an event or circumstance that precedes a failure, and may be called a near miss.

OSHA National Safety Council defines a *near miss* as an unplanned event that did not result in injury, illness, or damage—but had the potential to do so. Only a fortunate break in the chain of events prevented an injury, fatality, or damage.

Let me describe a personal near miss that could have resulted in a potential serious injury.

One night after doing field work on an investigation, I decided to have a steak and salad at a very reputable restaurant. As is customary, the salad arrived first and I dug in. While eating, I suddenly felt an unusual sensation in my mouth. Although I was hungry, I am so glad I did not aggressively bite down, because that "sensation" turned out to be a *sharp* piece of metal. Yes, I am a degreed metallurgical engineer, but my typical diet does not include *eating* metal, so I pulled the sharp metal from my mouth. Thankfully, no blood. I called for the manager and brought it to his attention. I asked him for an explanation as to why the piece of metal was in my salad. He went back to the kitchen to investigate and found out it was from the tomato slicer kitchen tool. He was apologetic, and I was just thankful I had avoided an injury. That near-miss could have caused serious injury. Not that every salad will have sharp metal, but this near miss reminds me to look before I eat.

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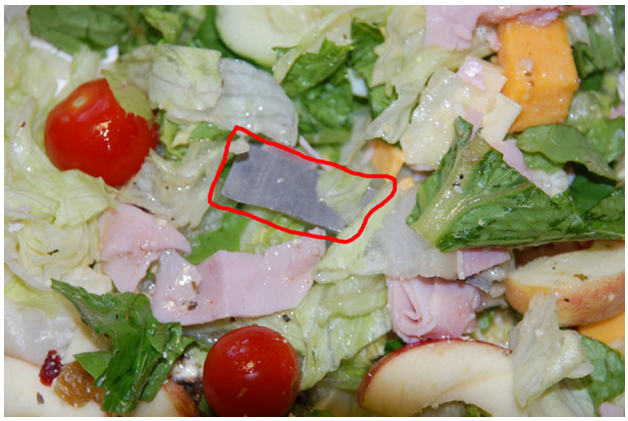

The red outline shows a piece of sharp metal found in a salad … a near miss injury avoided!

In the personal eating example, the situation can be considered a near miss, because the circumstances almost resulted in a personal injury. There are other near miss situations that involve parts, equipment, systems, and structures. From a designer's perspective, a component, part, or system is intended to perform a function under prescribed operating and design conditions. It is *important* that the design functions as intended. If for any reason, the design is compromised, malfunction and failure occurs. The equipment, part, or system has fallen short, and this should be reported as a failure or near miss and investigated.

For example, a small bolt that fails can have great or very little consequence, and may be a routine occurrence, yet it deserves absolute diligence and resolve to determine how and why that bolt failed. The precursor could be a loose bolt on a compressor because the bolt was not torqued properly or it loosened, eventually resulting in fatigue of the bolt. Fatigue failure of that bolt could then lead to leaking material—a near miss if caught in time. If the cause for the loose bolt is ignored, a major incident such as a fire can occur.

What actions should be taken when precursors or near misses occur?

- Identify a precursor or a near miss opportunity; do not minimize or ignore it.
- Investigate the cause for the near miss; why was the bolt loose?
- Determine whether the equipment is being operated as intended; has the usage changed?
- Communicate and report findings; are they documented?
- Follow-up and follow through; were actions taken to avoid this occurrence in the future?
- Ask the question, what could have happened next if this had not been found?

In my personal eating example, I did take action by talking to the manager and communicating what had just happened. I was informed that a tomato slicer tool had failed. I encouraged him to look at his kitchen tools to avoid another occurrence. Although I wanted to investigate, I was not able to do a thorough investigation of this particular failure and how the metal got in the salad. I hope the restaurant manager and staff followed-up on it with the manufacturer.

There are reasons to believe that incidents and failures are often preceded by less severe precursor events or near misses. If the precursors and near-misses are identified, investigated, and the reasons for occurring are resolved, communicated, and documented, then major failures can be reduced. The failure investigator can and should provide findings to explain what went wrong. If other precursors are discovered during the investigation that could cause the same (or different) failures, those can and should be passed on as well.

The Failure Analysis and Prevention Journal publishes many articles, case histories, and lessons learned to help investigators and engineers understand how failures occur. These articles are written, submitted, reviewed, and selected by the editorial board to help educate and enlighten readers. Some articles in the Journal that highlight precursors and near miss opportunities can be passed on so that that minor or even major failure can be prevented.