Errors, Accidents, and Causation—Questions and Answers

1. Are people who repeatedly experience unsafe events "accident prone"?

- *The only support for the theory of accident proneness is from examples of repeated accidents in excess of chance.* This theory of accidents was debunked more than 40 years ago (Gilmer, 1961[1]). "While it is true that some individuals have accidents repeatedly and that a relatively large proportion of accidents are experienced by a relatively small proportion of individuals, this can be explained by random variation."

- Assuming 100 accidents per year are randomly distributed (by chance) among 200 workers at a single location:
    - 121 people will have 0 accidents
    - 61 will have 1 accident
    - 15 will have 2 accidents
    - 3 will have 3 or more accidents

- Many reported studies do not take into account the extent to which all workers who had accidents also had equal exposure to risk. *Certain workers may have had an excessive number of accidents because they were exposed to hazards more often than their peers.*

- There is a concept that employees who make and report multiple mistakes to C[3]RS are responsible for the error. There is a tendency to worry more about *"blaming the victim"* (i.e. the employee) than really finding out the cause of the problem. Because there is a culture of blaming the victim and disciplining the employee for being the source of the problem, employees are unwilling to report close calls in open reporting systems.

- *Individuals who appear to be above average in error rates at work are probably working in a task, an environment, or a management system where workers are more likely to have high error rates.* For instance, Reason (1990[2]) stated that certain task characteristics increase the probability of omission errors, such as forgetting to set valves in the appropriate position.
    - The larger the number of steps in an action sequence, the higher the probability that one or more of them will be omitted.
    - The more lengthy and complex the instructions, the higher the probability that items within a step will be omitted.

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[1] Gilmer, B. von Haller (1961).Industrial Psychology. New York: McGraw-Hill.

[2] Reason, J. (1990). Human error. Cambridge, U.K.: Cambridge University Press

- Procedural steps that are not obviously cued by preceding actions or that do not follow a direct linear sequence from these actions are likely to be omitted.
- When instructions are given verbally and there are more than five simple steps, items in the middle of the list are more likely to be omitted than those at the beginning or those at the end.
- When instructions are given in writing, isolated steps at the end of sequence (e.g., replacing caps or brushes, removing tools, etc.) have a reasonably high probability of being omitted.
- Necessary steps in an action sequence are more likely to be omitted during reassembly than during the original disassembly.
- In a well-practiced, highly automatic task, unexpected interruptions are frequently associated with omission errors, either because some unrelated action is unconsciously 'counted in' as part of the task sequence, or because the interruption causes the individual to 'lose his place' when resuming the task (i.e., he believes that he was further along in the task prior to the interruption than he actually was). Such routine tasks are also especially prone to premature exits—moving on to the next activity before the previous one is completed—thus omitting some necessary final steps. This often happens when the individual is working under time pressure or when the next job is about to begin.

- The advantage to a close call reporting system is that tasks, environments, and other conditions that increase the probability of errors are detected before the system defenses are broached and an accident happens. Thus, *C^3RS can be reasonably expected to reduce "accident proneness"* in individuals and to enhance system safety.

2. Does C^3RS allow employees who repeatedly make mistakes to escape detection, thereby remaining a safety threat?

- C^3RS does not deal with accidents, only "close calls," where there are no consequences for the events reported. *Someone who repeatedly is involved in an accident would continue to be identified in the current system of reporting and discipline.*
- If an individual repeatedly carries out intentional acts of sabotage, regardless of the consequences, they would not be granted immunity under the proposed system.

3. What causes most accidents and risks?

- The modern view of accident causation (Reason, 1992) is that in a complex socio-technical work system, there are multiple factors that contribute to accidents. Unsafe acts or active failures committed by workers are frequent, but they rarely

result in an accident because complex systems have multiple defenses designed to prevent accidents.

- Potential failures are also frequently found in complex systems and operate at many levels above the worker. Corporate managers and line managers make decisions and supervise employees; this in turn can create conditions that allow unsafe acts to become accidents. Environmental conditions, equipment, task characteristics, employee training, motivation, and physical/psychological conditions also contribute to accidents. Several failures and conditions must occur simultaneously to defeat the system defenses and allow an unsafe act to become an accident.