

WHY EMPLOYEES DO NOT FOLLOW PROCEDURES

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Abstract

Many organizations dedicate considerable efforts in designing reliable management systems in an attempt to reduce variability in production and improve the potential for superior quality, safety and productivity. These systems operate under the assumption that employees will follow the established rules and procedures. However, when human factors are not considered in the system, errors and violations made by employees can put the entire management system at risk. There are many factors involved in the reason why employees do not follow established procedures. These factors can be very complex and involve organizational, management, motivational, job design, equipment, and environmental considerations, among others. This paper will evaluate these factors and the underlying environment which promotes procedure violations, through the review of publications and previous studies on human error. By considering these factors, measures can be adopted for the prevention and minimization of human errors during execution of operational procedures.

Why Employees do not Follow Procedures

Human errors account for most of the industrial incidents, resulting in considerable losses to the organizations. Among the several types of human errors, violations of established procedures are of particular interest. Violations can be defined as any deliberate deviation from the established procedures, instructions or regulations introduced for the safe or efficient operation of a process or maintenance of equipment. This applies to all levels, from operators to high level management. Departure from established procedures can be either unintentional or deliberate, where the actions (though not the possible bad consequences) were intended. However, violations are usually not willful acts of sabotage or vandalism. Contrary to expectations, procedure violations are usually the result of well intentioned employees attempting to get the job done, rather than by those who are only interested in their own comfort. It involves a conscious decision based on the perceived probability of the risk of accident or incident and of the detection and its consequences, as opposed to personal gain. While the deliberate failure to follow known procedures is called a violation when it goes wrong, when it succeeds it may be called the exercise of initiative.

The trend of procedure violations in the workplace must be carefully evaluated and addressed by management. Apart from the obvious potential problems to result in unpleasant consequences in product quality and efficiency of the process, violations increase the likelihood of an accident. The reasons for these potential consequences are:

- Violations take people outside the boundaries of safe working practices, making the environment less forgiving to errors. In other words, violations remove one layer of defense which aims to ensure predictable and safe working practices.
- Violations can themselves be errors when the individual does not know or understand the rule. This lack of understanding is dangerous in itself, because while not appreciating the risk, people often fail to protect themselves.
- Violations can take people into new or unpracticed situations, in which the person is more likely to make an error.
- Violations are breaches in the last line of defense. Procedures are barriers put in place because other alternatives, such as design, hardware and avoidance of the problem, are not possible.

Human Error and Violations

Violations fall under the category of human error, but not all human errors are violations. It is important to understand both concepts since both play an important role in the reason why procedures may not be followed.

In its basic definition, error is the failure of planned actions to achieve their desired goal. There are basically two ways in which this failure can occur:

- The plan is adequate but the associated actions do not go as intended. Actions deviate from the current intention. These are failures of execution and are commonly termed

slips and lapses. Slips relate to observable actions and are associated with attention failures. Lapses are more internal events and relate to failures of memory.

- The actions may go entirely as planned but the plan itself is inadequate to achieve its intended objective. These are failures of intention, known as mistakes. Here, the failure lies at a higher level: with the mental processes involved in planning, formulating intentions, judging and problem solving. Slips and lapses occur during the largely automatic performance of some routine task, usually in familiar surroundings. They are almost invariably associated with some form of attention capture, either distraction from the immediate surroundings or preoccupation. They are also provoked by change, either in the current plan of action or in the immediate surroundings.

Meister (1977) classified errors further into four major groupings:

- Performance of a required action incorrectly
- Failure to perform a required action (omission error)
- Performance of a required action out of sequence (combined commission/omission error)
- Performance of a non-required action (commission error)

Errors are not causes, they are consequences. All mishaps have both a context in which they occur and a chain of events from which they appear to have arisen (Tasker, 2000). This chain of causes involve the individual psychological factors (momentary inattention, forgetting, haste, etc), which are the last and often the least manageable link. Distraction, momentary

inattention, forgetting, losing the picture, preoccupation and fixation are entirely natural human reactions to the kind of working environment present in a typical workplace.

So far we have mentioned three forms of human error: slips, lapses, and mistakes. The fourth major form of human error is violations. Violations are distinguished from the more ordinary forms of error because there is the intent not to follow the rules; both the action and the specific behaviors are intended, unlike mistakes where the action may be intended, but the behavior is unintended in the light of the possible outcomes. Most forms of human error are not only unintentional; they can also be detected and recovered from. This means that someone who makes a simple slip or even a lapse can often detect that they have done so and take appropriate corrective action. When you take a wrong turning off a road, this is usually quickly obvious and the route to recovery simple. Mistakes are harder, but even here it may be possible to put things right once someone discovers that they are acting mistakenly. A mistaken choice of route to avoid a traffic jam may turn out to be eventually just a larger mistake if faced with an even larger jam. But even, then some recovery may be possible, even if detection of the mistake takes longer. Violations, on the other hand, are intended, although not because the violator intends harm. There is a certain correlation between the types of error, the existence and effectiveness of techniques for their avoidance and the opportunity for harm (Hudson, Verschuur, Parker & Lawton, n.d.).

- Most slips are benign and, because they are often quickly detected, frequently do not lead to damage or injury. Any system that is so designed that a slip, such as selection of the wrong one of two identical-looking buttons on a control panel, leads to a disastrous outcome is unacceptable. Such systems should have been identified and rectified by a

sound management system. As slips are caused by factors such as haste and divided attention, good work planning is also a highly effective remedy.

- Lapses are more dangerous because they may be missed. It is harder to spot that you have not done something. Forgetting to replace a gasket, failing to tighten a flange, missing a vital isolation check, are all examples of lapses. The problem may be compounded by the person's thinking that they have done the job completely, so an extra round of checks is not conducted. Lapses are especially dangerous in maintenance, where a problem may lie unnoticed until it is too late. Good management systems can require checks and balances for safety-critical activities, which forms one type of defense against the lapse.
- Mistakes are even more dangerous than lapses because those making a mistake think they are doing the right thing. They can be so sure of themselves that evidence telling them they are wrong is ignored. A mistake, such as failing to understand a pattern of alarms and deciding what to do on the wrong assumption, leads to performing the wrong corrective actions; it may be the first explosion that signals that a mistake was underway. Management systems will find mistakes harder to correct, but good training, supervision and support certainly help reduce the chance of making mistakes.
- Violations are most dangerous of all. They often represent a quite deliberate intention not to follow safety or other procedures which put everyone at risk. Management systems are not typically constructed with violation in mind and only truly inherently-safe systems could be automatically expected to survive all sorts of violations.

Violations differ from the other types of errors in a number of important ways (Reason, 2005).

- Whereas errors arise primarily from informational problems (forgetting, inattention, incomplete knowledge, etc), violations are more generally associated with motivational problems (low morale, poor supervisory examples, perceived lack of concern, the failure to reward compliance and sanction non-compliance, etc).
- Errors can be explained by what goes on in the mind of an individual, but violations occur in a regulated social context.
- Errors can be reduced by improving the quality and delivery of the necessary information within the workplace. Violations generally require motivational and organizational remedies.

Types of Violations

According to Hudson et al. (n.d.), there are five main violation types:

Unintentional violations

Erroneous or unintentional violations occur for two main reasons. First, they arise from procedures which are written in an attempt to control behavior that is impossible for the employee to control (e.g. do not slip or remain in control of your vehicle at all times). Second, unintentional violations may occur when employees do not know or understand the rules. This may be particularly relevant to new employees or when completing tasks that require adherence to a large number of rules. Strictly speaking, the definition of violation requires that deviation is

deliberate or intentional. However, from an organizational perspective, it is important that the unintentional violation of formal procedures be avoided.

Routine violations

Violations of this kind, as their name implies, are common practice. They often occur with such regularity that they become automatic and unconscious behavior, and they are recognized as such by the individual only if questioned. Such deviations from formal working practices are often perceived by employees to involve little risk and are accepted by the particular work group as the normal way of doing the job. In this case, violating the rule has become the group norm.

Situational violations

These violations occur as a result of factors dictated by the employee's immediate work space or environment, which make it difficult for the employee not to commit a violation. Factors such as time pressure, lack of supervision, unavailability of equipment and insufficient staff all have implications in terms of situational violations (e.g. when an operator improvises because the equipment specified in the procedure is not readily available).

Optimizing violations

This category of violations is related to the nature of the job or the task itself; as optimizing violations frequently occur in an attempt by the employee to make a job more exciting or interesting. These violations are related to the non-functional aspects of work (e.g. a desire to impress or relieve boredom). These violations are also associated with staff testing the safety boundaries of the system. In such cases, staff may actively search for ways of improving

production. These violations are more common when employees are involved in long periods of monotonous work or jobs where the rules are overly restrictive or seen as out of date.

Exceptional violations

As their title suggests, these violations are rare and tend to happen only in very unusual circumstances (e.g. an emergency, when something goes wrong, or equipment failure). They occur to a large extent when an individual is attempting to solve a problem in an unusual situation where existing rules and procedures are considered inapplicable to the specific circumstances or over-prescriptive. Exceptional violations can be the result of either a conscious decision making or instinctive reactions. The individual relies entirely on adapting basic knowledge and experiences to deal with the new problem and, in doing so, violates a procedure. Such violations are commonly associated with high risk, often because the consequences of the action are not fully understood or because the violation is known to be dangerous. An example of this type of violation might involve an employee entering a vessel to assist an unconscious colleague who has been overcome by fumes, despite procedures that forbid such rescue attempts.

Failure to follow a specific procedure action can be related to any of the forms of human error described. Following an error, there are two related aspects that must be considered. First, how did each defense or barrier fail? Secondly, why did it fail? Answers to the second question frequently, but not always, begin with unsafe human actions; that is, errors committed by those at the sharp end, people in direct contact with the operation or the system. But such active failures rarely arise solely from a defiant psychological processes or negligence. They are more often the direct consequence of error provoking circumstances within the local workplace. And these, in turn, are the product of higher level latent conditions: prior decisions by equipment designers,

senior managers, or the writers of protocols. They can also occur through the gradual erosion of safeguards by subtle and often well intentioned actions or changes in operating practices. A serious weakness of assigning blame to the individual is that, by focusing on the individual origins of error, it isolates unsafe acts from their system context. The same set of circumstances present in the system can provoke similar errors, regardless of the people involved (Graves, 2005).

By examining these ingredients of an error and by looking at aspects of the organizational process, such as communication, stress, and supervision, it should be possible to identify violation's key elements or potential causes. The occurrence of an unsafe act can be analyzed according to whether it was the result of an error or whether it was the result of some deliberate deviation from a regulated code of practice. These events can then be described as being either unintended or deliberate and represent detrimental acts committed by those at the sharp end or front line of practice.

All these causal factors for human error lead to the consideration of the type of gaps in the management systems that allow for these errors. There are two basic reasons: active failures and latent conditions. Nearly all adverse events involve a combination of these two sets of factors (Reason, 2000 & 2004).

Active Failures

Active failures are the unsafe acts (errors and violations) committed by people who are in direct contact with the operation or the system. They are the people whose actions can have immediate adverse consequences. These failures take a variety of forms: slips, lapses, fumbles, mistakes, and procedural violations. Active failures have a direct impact on the integrity of the

defenses. At Chernobyl, for example, the operators wrongly violated plant procedures and switched off successive safety systems, thus creating the immediate trigger for the catastrophic explosion in the core. Managers who like to place blame on the worker often look no further for the causes of an adverse event once they have identified these proximal unsafe acts. But virtually all such acts have a causal history that extends back in time and up through the levels of the system.

Latent Conditions

Latent failures are created as the result of decisions made by designers, builders, procedure writers, and top level management at the higher structure of the organization. Certain types of strategic decisions have the potential for introducing latent conditions into the system. Such gaps exist in all complex hazardous systems because the decision makers cannot foresee all the possible accident scenarios. Their damaging consequences may lie dormant for a long time, before becoming evident when they combine with active failures and local triggering factors to breach the system's many defenses and create an accident opportunity. Latent conditions have two kinds of adverse effect: they can translate into error-provoking conditions within the local workplace (e.g. time pressure, understaffing, inadequate equipment, fatigue, and inexperience) and they can create long-lasting weaknesses in the defenses (e.g. untrustworthy alarms and indicators, unworkable procedures, design and construction deficiencies, etc). Their effects are usually longer lasting than those created by active failures. They are also present within the system prior to an adverse event and can be detected and repaired before they cause harm. Unlike active failures, whose specific forms are often hard to foresee, latent conditions can be identified and remedied before an adverse event occurs. As such, they represent the primary

targets of any safety management system. Understanding this leads to proactive rather than reactive risk management.

The Direct Motivators and Behavior Modifiers

Up until this moment we have evaluated different modalities of human error and violations, along with some general factors which can promote employees to commit such errors or violations. However the overall causes of violations can be complex. Something that appears initially as a simple violation can hide complex causal factors.

There is a variety of factors which can influence a person's decision to knowingly break rules and these can be considered at two levels (Redmill & Rajan, 1997). First, there are factors which directly motivate the employees to break agreed rules or procedures. These factors will be called the **Direct Motivators**. The second level is of the supplementary factors which could increase or reduce the probability of any individual deciding to commit a violation. These will be called the **Behavior Modifiers**. For example, feeling tired at the third shift may be a direct motive to skip an arduous process step, but the absence of a Supervisor during the shift to monitor performance of the operation may be a behavioral modifier which increases the probability that the violation would occur.

It should be noted that the direct motivators and the behavior modifiers are not mutually exclusive but may overlap. The following table contains some of the most important direct motivators and behavioral modifiers.

The Direct Motivators	Behavior Modifiers
Making life easier	Poor perception of the safety risks
Financial gain	Enhanced perception of the benefits
Saving time	Low perceptions of resulting injury or damage to plant
Impractical safety procedures	Inadequate management and supervisory attitudes
Unrealistic operating instructions or maintenance schedules	Low chance of detection due to inadequate supervision
Demonstrating skill and enhancing self-esteem	Poor management or supervisory style
There could also be:	Poor accountability
Real and perceive pressure from the boss to cut corners	Complacency caused by accident free environments
Real and perceived pressure from the workforce to break the rules	Ineffective disciplinary procedures
	Inadequate positive rewards for adopting approved work practices

Violations are highly susceptible to management influences since many of the underlying causes of violations are created, often inadvertently, by management itself. Management is therefore in an ideal position to influence the behavioral modifiers, as well as some of the direct motivators. Let's evaluate in more detail each of these factors.

Direct Motivators

Making life easier

Making life easier for themselves is a prime motivator for many people to cut corners. An unwillingness to use the appropriate tools and safety equipment necessary to perform all tasks in

the agreed manner is a common problem. Equipment which is badly maintained, or a lack of suitable equipment, could result in alternative and unsafe procedures being adopted. Better design which makes equipment easy to maintain plays a major role in encouraging safe working practices.

Financial gain

Bonuses and recognition are often linked purely to the throughput of product, without considering most times the cost of poor workmanship on quality or costs resulting from incidents or accidents. Anything that speeds up a job results in financial gain for the individual. Such bonuses can therefore be seen to encourage violation of procedures, especially in those situations where supervisors are not present.

Saving Time

Finishing a task early is an important motivator to violate a procedure, especially if the task is unpleasant or if its early completion gives a person more time to spend on a more rewarding aspect of the job.

Impractical Procedures

The deliberate breaking of rules often occurs as a result of the rules being genuinely impractical or perceived as being impractical. In such instances the motive to violate may be to help the company to get the job done, as opposed to any personal gain. This would correspond to the type of optimizing violation previously discussed.

Safety procedures, for example, are often continually amended to prohibit actions that have been implicated in recent accidents or incidents. The resulting effect is that safety rules become increasingly restrictive. Furthermore, it is all too easy for management to introduce rules and

procedures, perhaps following an incident, without the full practical implications being considered. In such circumstances, rules and procedures can be thought of as being introduced simply to protect liability of management. Such over specification can result in permitted actions which are far less than those necessary under ideal conditions.

Although work practices seem easy to write, understanding and following them can cause difficulties. Some work practices have been shown to be impossible to adopt while others have not been fully understood. Maintenance workers may be asked to report back to management whenever they consider any working methods to be difficult to comply with, but in practice many workers would attempt to get the job completed using improvised methods.

Unrealistic operating instructions or maintenance schedules

Operating procedures which place excessive demands on the users are likely to be rejected and alternative improvised methods may be adopted. For example, the pre-use checks specified by equipment manufacturers can be excessive and can take a significant amount of the shift time to complete. Unrealistic procedures can cause a gradual unwillingness of the workforce to adopt certain working practices. Over time the erosion of the rules gradually becomes accepted practice by most workers. In such instances, the unofficial work practices come to be regarded as the norm and may even be taught to new recruits. This would correspond to the type of routine violation previously discussed.

Demonstrating Skill and Enhancing Self-esteem

There is some evidence that people's behavior is influenced by social image, and that the adoption of alternate procedures as a demonstration of their skills is a direct motivator. This motive is therefore likely to be strong with groups of individuals who consider themselves as

possessing higher than normal levels of work skills, especially where they are employed in jobs with low inherent demands on their abilities.

Real or Perceived Pressure from the Boss to Cut Corners

Repeated management expressions of concern over production or machine availability can easily create an impression that they are more concerned with production than with safety. Employees may therefore think that management would want them to cut corners and take risks if it speeds up the job. In order to look good to management some workers may be willing to violate rules.

Real or Perceived Pressure from the Workforce to Break Rules

Some studies have shown that individuals are strongly influenced by the behavior of their colleagues, even if they realize that the behavior is unsafe. There is a strong need to be seen by the group to fit in with its methods and values. This peer pressure to fit in, which may be either explicit or implicit, is likely to be especially strong for new young entrants into teams or during temporary replacements as a result of absenteeism. Pressure from members of the work groups and from the rest of the workforce who may have interests in keeping production going, for example to gain bonuses or recognition, should not be overlooked. New employees should ideally be placed only with teams with good record of following procedures.

Behavior Modifiers

Poor Perception of the Safety Risks

An individual often consciously balances the risk against the benefits before deciding to commit a procedural violation. It is therefore important to determine how an individual determines the degree of risk, especially when faced with new experiences. If employees

perceive the risk to be less than they really are, they may be willing to take a risk which would normally be considered unacceptable. Risk perception tends to be influenced both by an individual's own experience and by formal and informal training. Information provided by training or a deliberate program of extended work experiences may change the perception of certain practices, thought of as safe, to being unsafe and hence posing an unacceptable risk. People have to be aware of a hazard before they can make a judgment as to the associated risks to themselves and others. How people perceive this risk is central to the concern over deliberate breaches of safety rules and procedures.

Enhanced Perception of the Benefits

The personal benefits from working following established procedures are often non-existent in an organization. By comparison, individuals may see many benefits of breaking rules and procedures, in addition to the financial gains which can often arise. Instances are often reported of people being praised for their initiatives if they improvise to get the job done under difficult conditions. The violation of rules and procedures which this involves may appear to have been condoned as long as they did not result in unwanted events such as injury or plant damage. An attitude often develops where strictly adhering to the rules is seen as conflicting with the objectives of the organization.

Low perceptions of resulting injury or damage to plant

An employee may be more willing to deviate from a procedure if he or she considers it unlikely to result in injury or plant damage. It is important to study the risk perceptions of the employees and address misconceptions in training sessions.

Inadequate management and supervisory attitudes

Many of the issues related to procedural violations are influenced by management. In a production environment where the emphasis is on output, there can be a tendency to regard strict procedure adherence as undesirable, or as a cause of lost production. Employees can be strongly influenced by the perception they hold of management's attitude towards safety and compliance with procedures.

Low chance of detection due to inadequate supervision

Organizational factors may result in supervision only being present during predictable periods and violations may be committed with minimum risk of detection. Supervisors may not have been given sufficient detailed training to identify the occurrence of certain specific violations. They often concentrate only on the presence of unsafe conditions and not on unsafe behavior. The reason may be that it is easier to detect such conditions and rectify them, than to deal with the underlying cultural issues. The absence, inability or unwillingness of supervisors to effectively identify breaches in approved procedures removes a significant safeguard for ensuring compliance with working practices. Therefore, a low chance of detection can greatly increase the likelihood of violations occurring.

Poor management or supervisory style

Daily production pressures may lead many managers and supervisors to fail to develop an environment which encourages staff to follow established procedures. Unsafe practices may frequently go unnoticed or uncorrected. Whenever a manager encounters a situation in which procedures are not being followed and fails to take corrective action, he or she is seen by employees as condoning the breach. Probably without realizing it, the manager has demonstrated

to the workforce that he or she is not totally committed to the strict compliance with established procedures. This can eventually become as the normal or accepted behavior. It is therefore very important that any key leaders who may not always strictly adhere to established procedures are identified and their behavior changed. The effects they have on the behavior of other employees must be clearly reviewed with them.

Poor accountability

Any lack in clarity of roles, responsibility, accountability, and authority creates an organizational environment which can encourage violation of procedures. Individuals with the authority to decide work methods, but without any direct or immediate responsibility for production or safety consequences, are more likely to be motivated to commit violations than those who have been given responsibility for the operation. Individual employees should be held accountable for the outcome and consequence of the operation under their responsibility.

Complacency caused by accident free environments

The absence of an accident to someone who constantly and knowingly breaks safety procedures is taken as proof to him that his methods are safe. It would not be until a catastrophic accident, or a string of serious accidents to him, or others, which he would voluntarily choose to reconsider his perceptions of the risks or hazards associated with his job and to modify his behavior. To aid the avoidance of complacency, managers and supervisors must continually make workers aware of accidents happening at other locations.

Ineffective disciplinary procedures

Attitudes are shaped and developed by both the individuals and the circumstances surrounding them. Effective disciplinary procedures are essential in shaping the right behavior of

employees. Very often, leaders do not discipline a worker for violating a procedure for fear of the effect it would have on their working relationship. In this way, small offenses may become common practices.

Inadequate positive rewards for adopting approved work practices

The perceived benefits of omitting procedure steps can be said to be faster completion of the task, higher earnings, praise from others, and less effort. On the other hand, the unpleasant consequences for breaking the rules (e.g. injuries, damaged equipment, product defects) are usually infrequent and not as evident. Likewise, the natural rewards for any individual following the rules are usually non-existing. After all, they are just acting as expected of them. It is rare for someone to receive praise for working strictly by the rules, since this should be the normal expectation. However, when small rewards have been offered they have been shown to be effective. Recognition does not have to be monetary to be effective. Many people argue that a simple praise from supervisors or managers can be a strong incentive for many employees.

Motivational Aspects

Other aspects to consider when evaluating potential reasons why employees may fail to follow established procedures involve the traditional motivational theories. Within this framework, we can consider procedure violations to be caused primarily by the following type of motives:

Motive A: that which gives financial reward;

Motive B: that which leads to group acceptance, affiliation, or social benefit

Motive C: that which gives ego or self-fulfillment, power, or achievement advantages

This set of motivational factors follow the hierarchy of needs model developed by Maslow, which suggested that there were a number of motivators, but that only one operated at a given time and that they occurred in a set order (Certo, 2003). According to this model, the most basic motivator consists of the physiological needs of food, shelter, clothing, etc. The second level is personal safety. The third is social needs or need to be accepted by a work group. The fourth level of motivation consists of the ego needs, and the final level is the need for self-fulfillment. Using this model, it may be expected that people who commit violations of the type Motive C are operating at a higher motivational level in the Maslow model than those committing Motive A and B violations. Senior employees who are more likely to be working at the higher levels of the hierarchy may be more likely to commit Motive C violations because of their needs to achieve results of gain power. The motivational theory reflects a need to develop a system which fully takes into account the different needs and motives of different types of people, both in terms of their position in the organization and their personalities.

Procedure Design Factors

Apart from the real personal and organization factors that influence the violation of procedure steps, many of the procedure violations and errors stem from a poor procedure management. A direct, clear, effective, well written, and well instructed and understood procedure should reduce the likelihood for violation or omission. The existence of good procedures requires a procedure design policy to be implemented by plant management. This should include elements such as participation by the eventual users of the procedures, design of the procedure based on analysis of operational tasks, their preparation in accordance with accepted human factors principles, and a system for modifying the procedures in light of operational experience.

There are some common problems with procedures which often lead to violations.

Procedures are often developed when a system is first commissioned and are seldom revised to take into account operational changes. In addition, procedures are often not written on the basis of a systematic analysis of the task as perceived by the operators or other personnel who have to use them. This could cause that the user does not understand the underlying reasoning behind the procedure and therefore carries out alternative actions that appear to achieve the same purpose but are easier to perform. For this reason it is important that individuals who are going to use procedures are actively involved in their development. In addition, effective updating and auditing systems need to be in place to ensure that procedures are correct, and available to the persons who need them.

All forms of human error (i.e. slips, lapses, mistakes, violations) can cause a person to skip a procedural step. The failure to carry out necessary steps of a procedure is probably one of the most common human errors. Therefore, it is worthwhile to focus some attention on the factors that cause omission of procedure steps.

According to Reason (2002), there are a number of task properties that are likely to increase the probability that a particular step will be omitted. Some of the more important of these features are as follows:

- The informational loading of a particular task step

The higher the demands imposed upon short term memory, the more likely it is that items within that step will be omitted.

- Procedural steps that are functionally isolated

Steps that are not obviously prompted by preceding actions or follow in a direct linear succession from them, are more likely to be left out.

- Recursive or repeated procedural steps are particularly prone to omission.

In the case where two similar steps are required to achieve a particular goal, it is the second of these two steps that is most likely to be neglected.

- Necessary steps that follow the achievement of the main goal of a task are likely to be omitted.

This is an instance of a general principle: steps located near the end of a task sequence are more prone to omission. Such premature exits are due in part to the operator's preoccupation with the next task, particularly when the current activity involves largely routine actions.

- Concealment of actions

Steps in which the item to be acted upon is concealed or lacking in conspicuity are liable to omission.

- Steps following unexpected interruptions are especially prone to omission.

This can occur because the person loses her place in the action sequence and believes herself to be further along than she actually is, or because some unrelated action is unconsciously counted in as part of the task sequence.

- Continuous tasks not contemplated in procedure

Tasks that involve planned departures from standard operating procedures or from habitual action sequences are liable to strong habit intrusions in which the currently intended actions are supplanted by a more frequently used routine in that context, and thus omitted.

- Weak action triggers

Actions that are triggered by weak, noisy or ambiguous signals are likely to be omitted.

A number of these omission provoking properties can combine in a single task step. When this occurs, the effects are additive and the result is a recurrent error trap that predictably entraps a large number of people.

While it is not always possible to identify which mental process failed in omitting a necessary step from a task, we can predict with some confidence which task elements are most likely to provoke such omissions. The likelihood of an omission is related to the number of omission provoking features associated with a particular task step. The more features are present, the more probable the omission. There are some actions that management can take to address this issue. These include: 1) conduct a task analysis, 2) assessing omission likelihood, and 3) choosing and attaching a reminder.

Task analysis

It is necessary to carry out a task analysis. This consists in a process that decomposes an activity or procedure into a meaningful number of discrete steps. This is not particularly difficult but it can be labor intensive.

Omission likelihood

Because omission provoking features are not always intuitively obvious, it is necessary to review each task step for its omission features. Any step that possesses two or more features is a candidate for a reminder, although such judgments should also take into account both the safety criticality of the step and the ease or difficulty with which its omission could be detected before the task is complete.

Choosing and attaching a reminder

Some type of reminder can be incorporated as part of the written procedures to help employees remember to execute critical steps. These can be in the form warning flags, bold instructions, requirement for signatures, visual object, etc. The appropriate and sparing use of good reminders will achieve some reduction of safety critical errors or omissions. Those engaged in the task are often the best people to design and apply a reminder. It must be recognized that all reminders have limits to their utility. Sooner or later they are likely to merge into the background and need to be updated.

In considering all these factors, it is also important to keep in mind the clarity of instructions contained in the procedure. This refers to the clarity of the meaning of instructions

and the ease with which they can be understood. This category includes both language and format considerations. Wright (1977) discusses four ways of improving the understanding of technical instructions.

- Avoid the use of more than one action in each procedure step
- Use language which is brief but comprehensible to the users
- Use the active voice (e.g. “rotate switch 12 A” rather than “switch 12 A should be rotated”).
- Avoid complex sentences containing more than one negative.

Another important consideration when writing procedures is how much information is necessary for the operator. Too little information may be inappropriate for an inexperienced process worker, while too much may encourage a highly experienced worker not to use the procedure or skip procedure steps. The level of the worker experience and the criticality of the task will determine the level of description.

There are other error-inducing factors that should be considered. According to the American Institute of Chemical Engineers (1994), these include the following:

- Frequency - The frequency with which a task is performed or a process event has been dealt with in the past, affects the likelihood of errors. Operational skills that are not frequently practiced, or procedures that are not used frequently, may cause performance problems.

- Complexity – The range of operations to be carried out, the interrelationships of the operational variables involved, and the required accuracy will affect performance.
- Perceived Danger – One of the most serious stressors to personnel working in many processes is the perception of danger from ineffective control and supervision of these systems. An environment that is perceived as being highly dangerous will increase the stress experienced by the workers while following procedure steps and may have a detrimental effect on their performance.
- Time Dependency – Time dependency refers to the time available to cope with a process event. Time pressure is a well-known stress factor which affects human performance and may cause omission of procedure steps. A well written procedure must consider the time that would take a normal operator to perform a required step.
- Physical environment in the workplace – These conditions include noise, lightning, thermal and atmospheric conditions. If the quality of these factors is poor, they may cause anxiety and fatigue which may result in errors. Working under these conditions means that more work and more attention and memory resources will have to be used on each individual action. Also, where these conditions are inadequate or simply unpleasant to the workers, people may tend to hurry a task and omit a critical procedural step. The existence of these stressful conditions can also indicate a lack of management concern for the well being of the workers, which can increase unsafe behavior.
- Work pattern – Two work pattern considerations are the duration of work hours and rest pauses, and the type of shift rotation. On many occasions, long hours of work are

required because the worker may have to stay on duty at the end of the shift to fill in for someone on the next shift, or because there are plant start-up or shutdown operations.

These conditions could cause fatigue in the worker, which can lead to errors. Shift rotation requirements may mean that a worker be subjected to sleep deprivation. These conditions have the same effects of fatigue which make a person prone to errors.

The existence of good quality procedures does not guarantee that they will be used. If a culture exist that encourages workers to take shortcuts not specified in the procedures in order to achieve required production levels, then procedure violations may still occur. These are typical issues that are considered by the socio-technical approach. The socio-technical systems perspective is essentially top-down, in that it addresses the question of how the implications of management policies at all levels in the organization will affect the likelihood of errors with significant consequences. The socio-technical systems perspective is therefore concerned with implications of management and policy on system safety, quality, and productivity. This is because many of the factors that have been shown to be the antecedents of major operational incidents (e.g. poor procedures, inadequate training) are not usually under the control of the individual worker.

The measures described before addresses both aspects of error management: reduction and containment. Understanding the omission features of a task will enhance the likelihood of error detection, even when omissions still occur, since an expected slip is more likely to be identified and corrected.

Training

Training can be an effective method to address many of the issues related to human error and procedure violations. An effective training program should help an organization to establish some minimum knowledge basis to enable the workers to perform their tasks with competence. Training should also be used to stress the importance of following procedures and the dangers and potential consequences of deviating from established guidelines.

For a training program to be truly effective, it must consider many complex factors. These factors include:

- Task difficulty
- Predictability of events
- Controllability of events
- Frequency of events
- Severity of consequences of error
- Stressors
- Access to help
- Environmental constraints
- Cultural aspects

Perhaps most important is the consideration for the type of audience for which the training is developed (i.e. level of experience, personal attributes). People differ in the knowledge level they poses at the start of training, the way in which this knowledge is processed, the way in which they prefer and are able to learn, the speed with which they can assimilate new

information, and their confidence in dealing with new situations (Redmill & Rajan, 1997).

Individual differences in learning mean that training methods should be flexible and adaptable to the rate of learning of individuals. Some people may be generally slower than others. Some may be slow in some subjects but able to grasp faster other concepts. The main aim of training should be to ensure that all personnel attain a satisfactory level of competence. If one person takes more time to learn than a colleague, this may not be a significant consequence if both are fully reliable when their training is complete. However, the problem or challenge may be that not all training programs are designed considering this fact. Most times than not, training programs are developed in certain standard way without the necessary flexibility to account for differences in learning rates of the individuals. Management must pay a lot of attention to these issues in order to establish a truly effective training program.

Conclusion

We have been able to evaluate the factors that influence employee behavior resulting in violations of procedures and errors. These factors are both internal and external. The aspects of motivation, behavior, and job methods can be classified as internal factors. On the other hand, factors such as supervision and work environment can be considered external factors. Practical management strategies for reducing violations can be developed by identifying all these internal and external factors which are likely to influence attitudes and hence the behavior of the workforce. Organizational measures should be directed mainly at improving management and supervision methods, job design, procedures design, equipment design, and training. But any management strategy must first begin with an honest and evident management commitment. It has been seen that real or perceived pressure from the supervision or management to cut corners

can promote procedure violations. Management must consistently show commitment to, and an active interest in, compliance at all levels of the organization.

Management must be alert to poor employee perception of the safety or operational risks and it is important that information about consequences is effectively communicated to all employees. Management must continually monitor for any situation which is not up to the expected standards and then always undertake actions to correct the situation or, in exceptional circumstances, to discipline individuals concerned. The organization should have an unambiguous policy regarding the expected behavior of the employees. The reason for discipline should always be clearly given and discipline should be administered soon after the violation is identified. Supervisor should be consistent and never condone a procedure violation under certain conditions but not others. Any disciplinary action must be taken with extreme care ensuring that what get criticized are the unsafe practices and not the employee.

All hazardous technologies possess barriers and safeguards. When an adverse event occurs, the important issue is not who made an error, but how and why the defenses failed. There should not be a focus on blaming individuals, but rather an adequate evaluation of all the potential contributing internal and external factors in the organization. The same set of circumstances present in the system can provoke similar errors, regardless of the people involved. At the same time, management must praise individuals when jobs have been completed in the right and safe manner. High productivity should never be recognized when it was achieved by skipping or violating procedure steps.

As seen, a well designed and written procedure can help reduce the likelihood for errors. To accomplish this, there should be an effective job design, task analysis, and the use of

reminders in the written procedures to help reduce the likelihood of omission of procedural steps. Then, an effective training program must be implemented to assure that all employees have a minimum level of knowledge and are aware of the implications of violating any procedure. In considering all these factors to ensure compliance with existing procedures, it would be helpful for managers to ask themselves the following key questions:

- Do employees know and understand the procedures?
- Are there situations when it is impossible to apply procedures?
- Does the job itself encourage violations?
- Are there alternatives to procedures?
- Is it possible to have a procedure for every situation?

The answers to these questions may provide the insight to more efficiently address violations issues and strengthen the management system.

Finally, as it has been seen, the psychological antecedents of a human error are very complex and, beyond a certain point, extremely difficult to control. Also, both internal and external factors can operate at the same time and make the identification and management of violations and errors further complex. For this reason, it is the opinion of the writer that an essential prerequisite for operations is the expectation and assumption that errors will always occur. A sound operations management should be built under the assumption that continuous vigilance and adjustments are necessary to effectively address the potential of procedure violations. Although errors may never be eliminated completely, the conditions under which people work can be improved to eliminate the conditions that facilitate that procedure steps may be omitted and to increase the chances of detecting and recovering from errors. Perhaps the most

significant consideration from this paper is that, although we cannot change the human condition, we can change the conditions under which humans work in order to reduce the likelihood of errors.

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