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Procedures

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What are Procedures?

A procedure is a series of actions that are done in a certain way or order, or an established or accepted way of doing something (Merriam-Webster). A major point of a procedure is to state what is to be done and in what order to maximize safety and efficiency. Procedures should be well thought out, organized, and clearly written. They should be well tested and checked for accuracy and redundancy.

A factor that is many times overlooked, a documented procedure should be examined for ease of execution. If people find a part of the procedure inconvenient, they may be more likely to make a mistake. Complexity should be reduced. The senior author remembers seeing a twenty step chemical procedure in a sequence of 16 other similarly complex procedures. In all there were some 400 different steps with complex procedures inside an overall complex procedure. The consulting opportunity did not materialize. *"Debugging"* this nightmare was likely to be expensive.

Procedures should avoid problem processes. These are processes which are difficult to execute or cause problems now or later on in the process. An example of a problem process is where lumps are formed when a powder is added to a liquid. The procedure causes the problem, and must initiate steps to fix or solve the problem. It is much better to add the powder to the liquid in such a way that lumps are not formed. Various techniques are available to do this.

Another example is where air (or gas) is incorporated or entrained in a viscous liquid, perhaps from the liquid surface. Time, then, has to be added to the procedure to have the gas leave the viscous liquid.

Air (or gas) is routinely incorporated into ice cream to increase volume. The air lowers the force needed to scoop the ice cream. Air has no calories and does not cost anything. A four win solution: increased product volume, lower scooping force, no calories and no additional cost.

In many other cases, however, incorporated gas can take a long time to leave a viscous liquid. It is much better to not incorporate the gas to begin with. The techniques are also available but may be less developed or optimized. Small scale testing can be done in order to determine the viability of change in procedure before a change is implemented. Operations in sealed systems or under vacuum are possible solutions.

It has been the experience of these authors that many procedures need further development.

Why are You Doing the Process this Way?

Procedures most often do not include information on why. This information should be added to reinforce operator training.

The procedures may be doing "things" in certain ways because of:

- Product quality
- Increased throughput
- Lower costs
- Increased yield
- Safety
- Efficiency in setting up for a later process

The procedure may also be doing "things" in certain ways because of safety reasons. These safety reasons should be stated clearly in the procedure. In one example, an operator was told to add material to a large reactor one scoop at a time every 3 minutes or so. The "Why one scoop at a time every 3 minutes or so" should have been explained to the operator. Unfortunately, in this case, the "Why" information was not explained to the operator. After two weeks of doing the procedure correctly, the operator picked up the entire bag and quickly added the material to the reactor. The operator then turned to walk way. He did not get very far when the reactor exploded and killed him. It cannot be understated that a casualty is the largest single cause of negative economic impact.

What Happens if You don't Follow the Procedure?

Procedures do not generally include scenarios. They do not include "what happens games". However, these can be instructive to enforce a proper procedure implementation. Industry should make an attempt to avoid accidents even more so than the industry is doing now.

Every procedure should be followed up by a document containing the most common accidents and prevention or minimization scenarios.

Although the time and place of some types of incidents are outside the realm of prediction by humans, some events always occur. In fact, some accidents are invited to occur. For example, if you have a house on top of a hill with a lightning rod attached to the roof, lightning will strike the rod. In this case, the place is known, i.e., the rod. However, the time of a lightning strike, the event, are not known. You are not even sure that there has to be a storm for lightning to strike. In the event of the inevitable storm however, it is much preferable for the lightning to be drawn to a place that can be controlled rather than elsewhere.

You Should not be Allowed to Add Time to the Procedure

Each step in a procedure should be timed. The step in a procedure should be given a length of time in which the step is accomplished. Adding time or removing time to a procedure should be considered a safety violation. The time taken between steps should be stated and strictly followed.

Starting a procedure and then halting the procedure at some step

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does not mean that the process stops at that point too. Procedures and processes are not static with time but instead can easily change with time. There are many examples of where adding time to a procedure resulted in an accident. In one accident, an operator was making throat lozenges. He did this procedure for two years with no difficulties in an enclosed room. He filled the kettle with alcohol. However, it was time for coffee and left the room. He returned to the room 15 minutes later to continue the procedure. Unfortunately, the air in the room was saturated with alcohol at this time. It is thought that a small spark was generated which flashed the evaporated alcohol. The operator died.

In another accident, a premix tank was used to feed material to a larger reactor. It was near a holiday season and there was not enough material to complete the premix. The procedure stated that if this occurred, the material should be drained from the premix tank and stored in drums. The operators did not follow this procedure. They saw no difference between the premix tank storage and drum storage. Unfortunately, a plug formed at the bottom of the tank over the holidays. Upon returning from the holidays, they finished adding material to the premix tank. They, then, tried to push the premixed material into the larger reactor but could not due the plugged line. At this point, the material in the premixed tank became a bomb. Eleven hours later the bomb went off, killing operator.

At the heart, procedures are about training. Training is essential for any job, and in industry failing to follow the proper procedure can have devastating and expensive consequences. It is hoped that those who design the procedure can perform their duty with the proper gravity in order to ensure operator safety, stakeholder satisfaction, and company success.