Making Operational Excellence Work for You

May 16, 2000

Williamsburg, Virginia

SWISS CHEESE MODEL OF DEFENSES

Operational Excellence = No Errors, No Spills, No Leaks

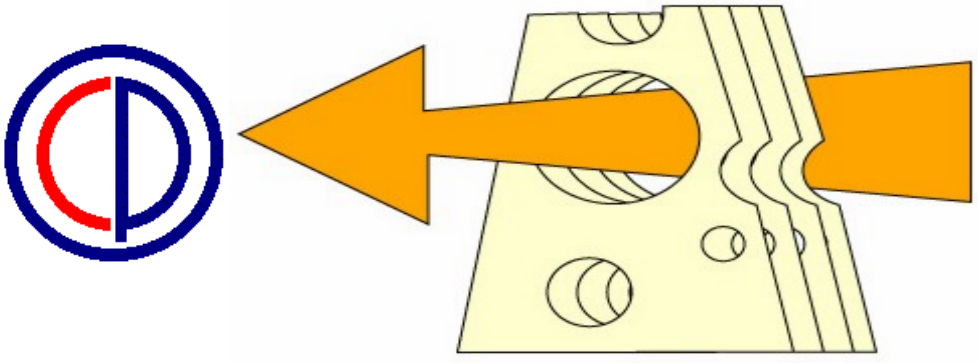
Here's how Swiss cheese applies to Operational Excellence, and why it's important to understand this concept. Any organization produces goods or services. To the extent that an organization exposes persons and property to hazards, the organization requires various forms of protection to avoid the contact of those hazards with persons and property. For Colonial, we have to protect persons and property from contact with hazardous liquids and their effects.

Dr. James Reason is an internationally recognized authority on human error and organizational accidents. He has developed the "Swiss Cheese Model of Defenses." Defenses serve these purposes:

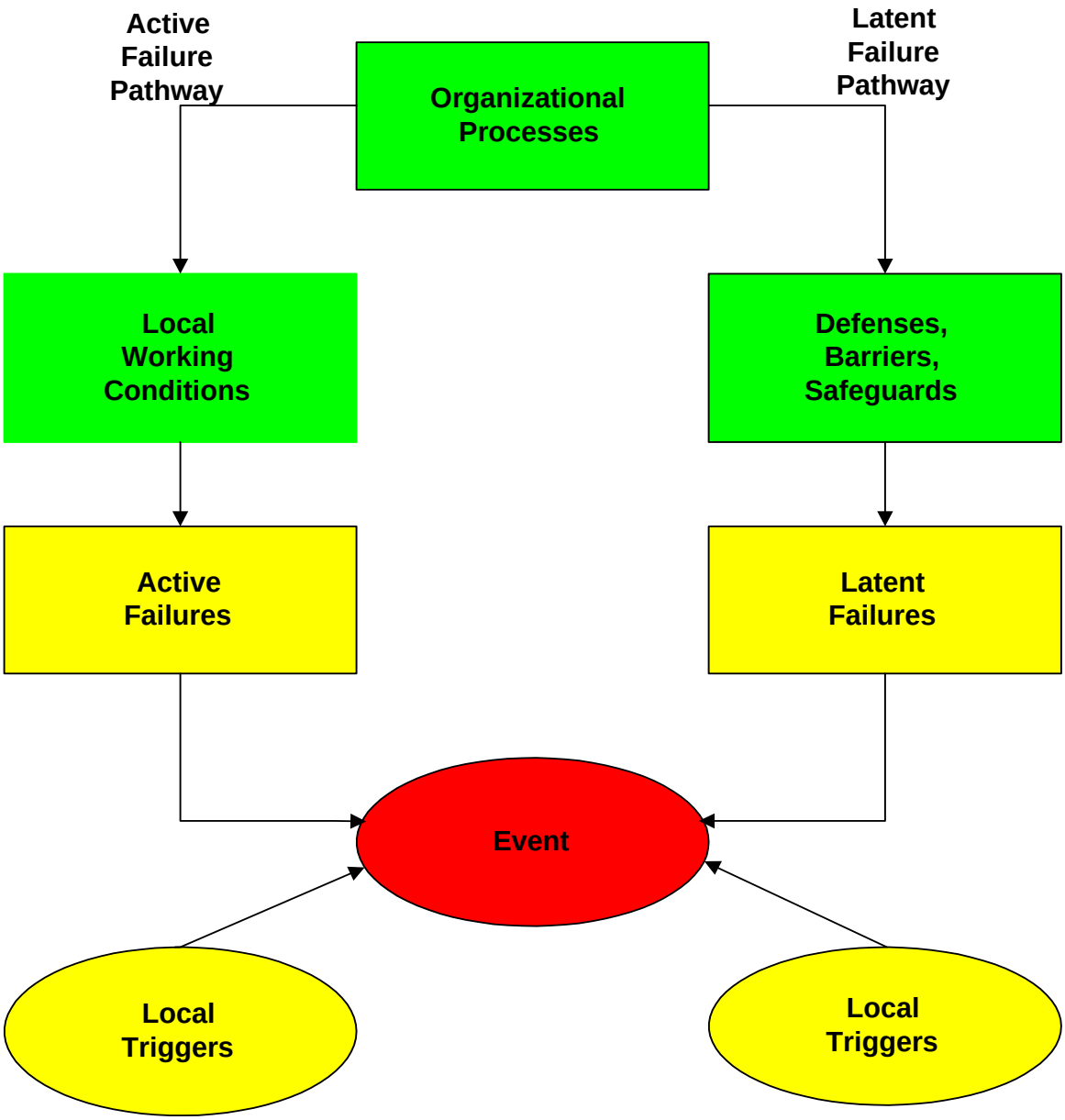
- Create *understanding* and *awareness* of local hazards
- Provide clear *guidance* on how to operate safely
- Provide *alarms and warnings* when danger is imminent
- *Restore* the system to a safe state in an off-normal situation
- *Interpose* safety barriers between the hazards and the potential losses
- *Contain* and *eliminate* any hazards if they escape the barriers
- Provide ways of *escape* and *rescue* if hazard containment fails

In an ideal world, all defenses would be solid, so no penetration by possible accident trajectories could hit the organization. In the real world, even an organization armed with complex, well-defended technologies is subject to gaps in the defense similar to the holes in Swiss cheese.

A wise organization has **several** layers of defenses between the hazards and persons and property. The problem occurs when layers of defenses are weakened through the *latent conditions* - such as poor design, gaps in supervision, undetected defects in materials, maintenance failures, bad procedures, clumsy automation, training deficiencies, inadequate equipment - that may occur over a period of time. ***If and/or when*** one of those weakened layers combines with what is called an *active failure* - such as a human error or violation, the result is a trajectory through the holes in the defenses. An incident occurs and can cause an explosion of consequences. The cure is to build a safety culture in the organization.



ACCIDENT CAUSATION MODEL



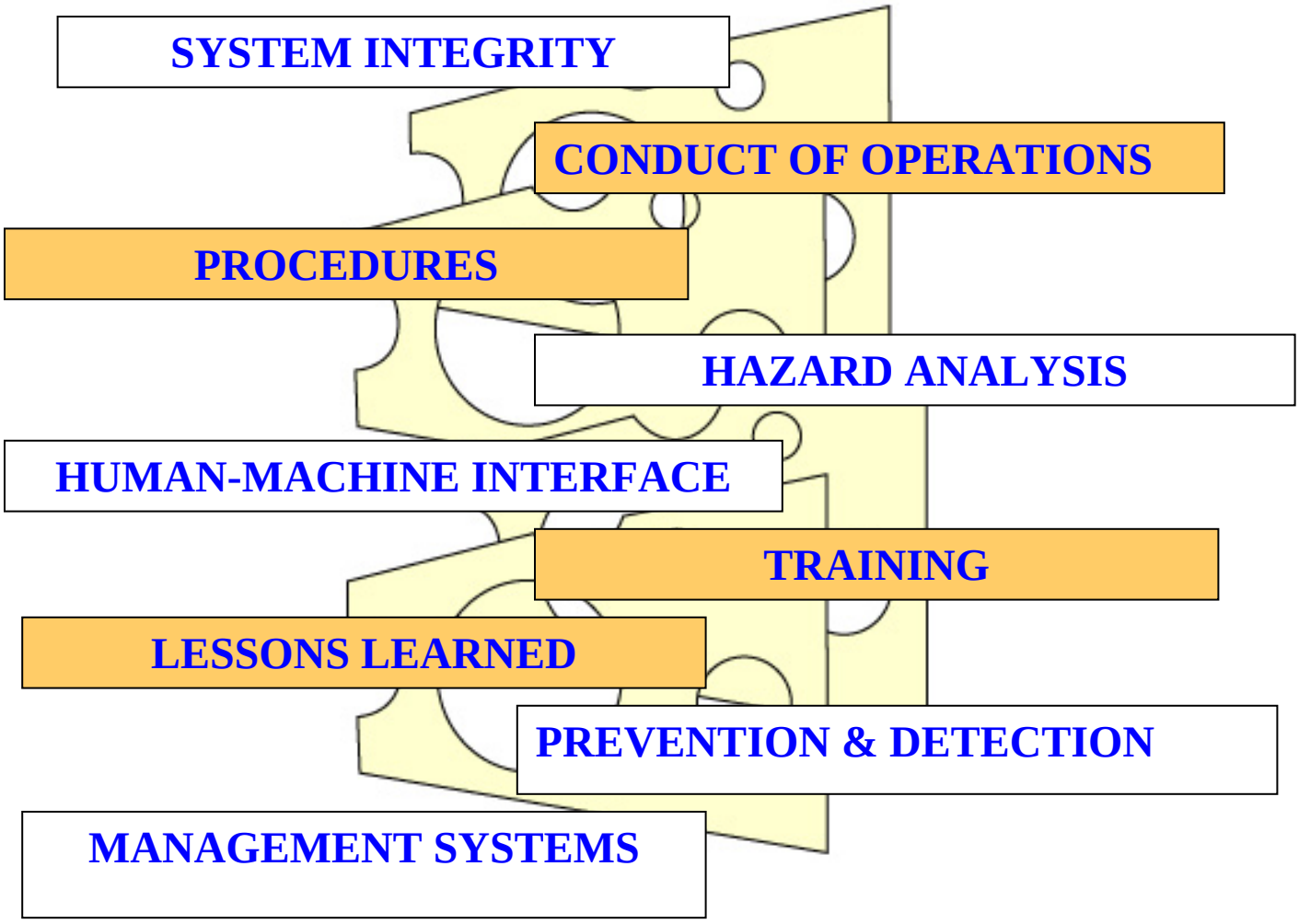
STEP 1: All organizations operating in hazardous conditions have processes, a culture, a variety of workplaces with local working conditions, and defenses designed to protect people, property, and the environment from any negative impact by those hazards.

STEP 2: When people are involved in an organization, there will be failures. Active failures have an immediate and direct impact, while latent conditions may exist for a long period of time before possibly combining with active failures or local triggers to cause an event.

STEP 3: A local trigger initiates an event AND/OR the defenses are penetrated AND/OR the local working conditions break down. The holes in the Swiss cheese allow a hazard to strike the organization.

STEP 4: A clear separation exists between the active failure pathway and the latent failure pathway. If the holes in the Swiss cheese are perfectly aligned, the consequences can be disastrous.

WHAT IS COLONIAL DOING TO AVOID EVENTS? TO CLOSE THE GAPS?



These are examples of processes, programs, and mechanisms that organizations may use to prevent or mitigate factors that cause errors, spills, or leaks. Here are some tools that can be applied as you make operational excellence work for you:

- Conduct of Operations Assessment Tool
- Self-Assessment Tools for Conduct of Operations
- Error Awareness and Reduction Techniques
- Operational Communication Methods