

Symptoms of Operational Error

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ABSTRACT. Operational error has occurred whenever unplanned and undesired results stem from the acts or decisions of supervisory management. With that definition, the author relates safety to organizational improvement and offers eight aphorisms to guide the safety director in performing his role as a manager in the organizational context.

The themes advanced in this article were developed as the opening topic in a course in safety management. They were meant to open the door for course content to follow, content dealing with the management of a function rather than the do's and don'ts of safety technology. Robbed of the opportunity for full exposition, the themes have an aphoristic brevity for which I apologize. It may serve, however, to outline the role of the safety director as a manager, to help orient less experienced safety men, and not be uninteresting, perhaps, to the safety professional.

All Themes Tied Together by One Principle

One principle ties all the themes together. "The function of safety is to locate and define operational error." This quote, taken from an article by Pope and Cresswell in the *Journal of ASSE*, becomes the logical base to discuss the supervisory-management aspects of safety management. If the function of safety is to locate and define operational error, how does the safety director operate within the managerial context to do so? What is operational error; how is it defined? What effect do operational errors have on an organization? What effect do they have in implementing safety controls? How does the newly appointed safety director implement fundamental change in an organization instead of merely preaching his newly acquired "do's and don'ts" of safety? In short, how does he operate as a manager?

It becomes necessary now to attempt a definition of operational error. Operational error has occurred whenever unplanned and undesired results stem from the acts or decisions of supervisory management, or the failure to act or decide. The term "supervisory management" encompasses the entire management structure from chief executive to the lowest level of front-line leadership.

What are "unplanned and undesired results?"



"When operational error is corrected to prevent accidents, injuries and unsafe acts and conditions, we at the same time achieve supervisory-management improvements that help to prevent the daily incidents of waste, inefficiency, re-work, ball-ups, and snafus." Photo courtesy of ECA Corporation, Bedford, Mass.

Examples are endless, including occasional accidents and injuries. If the customer ordered green and we send him pink, operational error has occurred. If 300 gallons of product go down the drain (memorable since the product was beer), operational error has occurred. If the crew goes to one location, the power equipment to a second, and an angry supervisor waits at the actual job site, we have an unplanned and undesired result stemming from operational errors. The examples of waste, "ball-ups," and snafus are indeed more common and more costly than the occasional accident or injury, but such incidents have no name. We recognize, define, and name the particular incident we call an accident; but all such unplanned and undesired results stem from operational error.

The operational errors which result in accidents and injuries also produce the endless array of other unplanned and undesired results which supervisory management contends with every day. The unplanned and undesired result is merely a symptom. The accident or injury is a symptom. So is the shipment that goes astray, the contaminated batch, the customer badly served, the snafus that snowball into major events. All are symptoms of the same underlying operational errors.

Must Modify Our Definition

But is it the function of safety to "locate and de-

fine operational errors" that result in rejects, contaminated batches, badly served customers, and similar snafus? Clearly these are beyond the scope of safety, so we must modify our definition. The function of safety management is "to locate and define the operational errors which can produce the symptoms we call an accident and/or injury." So modified, the definition suggests the scope of the safety function and indicates the safety director's role as a manager.

His role as a manager is to harness and improve the supervisory-management skills of his organization to achieve safety objectives. No organization is perfect; all have strengths on which to build, and weaknesses to buttress in an ever-shifting process of change. To this task he brings a knowledge of management principles and practices in addition to his input of safety knowledge. In the process he improves the competence of the organization to achieve any of the purposes and goals of management.

The point can most readily be seen in its extremes. At one extreme, excellent safety performance cannot be attained in a generally poor organization. The skills, procedures, policies, and direction to achieve any of the goals of management (indeed to define the goals of management) simply don't exist. At the other extreme, excellent organizations frequently achieve excellent safety results in the absence of any "visible" safety program as such. Safety management cannot lift safety performance above the level of competence generally exhibited by the organization. It can only lift it to the same level. Thereafter, improvement in safety performance requires organizational improvement. Conversely, safety improvement achieves organizational improvement as a corollary.

Modern concepts of systems safety encompass this idea, since all of the acts of supervisory management are part of the system. But we need not implement systems safety to operate on the principle of "locating and defining operational errors." We can fit the principle into safety theory by slightly modifying Heinrich's old and familiar Dominoe sequence.

Direct, Simple Approach by Heinrich

Heinrich's approach was direct and simple. He centered on the unsafe act or condition in the accident sequence. Interrupt the sequence by removing the unsafe act or condition and the accident with its possible attendant injury won't happen. It provided an entering wedge into the chaos of all knowledge which is encompassed by safety. Focusing on conditions, safety professionals have delved into engineering, physics, and chemistry to construct one great branch of safety technology—that dealing with things. Focusing on unsafe acts, we have delved into psychology, medicine, biology, sociology, and communication skills to construct another great branch of safety technology that deals with people. When we

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Before he assumed his present position nine years ago, he served on the faculty of the Traffic Institute at Northwestern University, and for seven years served as a consultant on safety management to industry and developed courses in industrial and motor transportation safety at Purdue University. Earlier experience included five years at the Institute of Public Safety at Penn State.

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have delved into things and people, we have delved into all there is, borrowing our knowledge from all disciplines of learning.

To this mass of all-encompassing knowledge, safety brings a format to think with, or perhaps several as sophistication grows. Industry is imbued with Heinrich's format, in terminology, in supervisory training, in the nature of the data recorded, in analysis, and in the practices and procedures based on that thinking. Had organized industrial safety been founded on the concepts of epidemiology or of systems theory, our thought, our literature, and our practices would be much different. Not necessarily better, but different.

Heinrich's shrewd focus on unsafe acts and conditions provides an entering wedge for thinking about cause and prevention. That thinking, however, diverts into undue preoccupation with fault of persons. The format offers no peg on which to assess supervisory management practices.

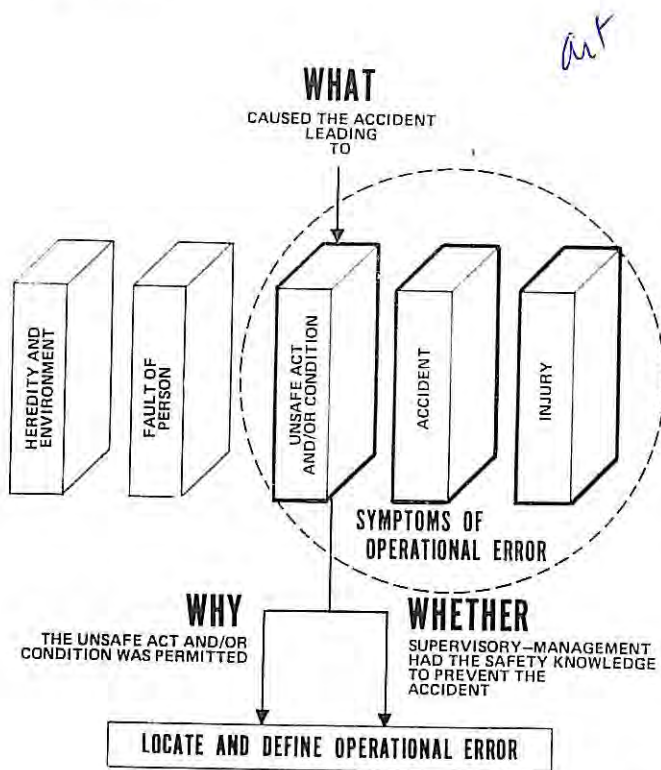
None of us, not even expert psychologists and psychiatrists, can brag excessively about success in understanding and "correcting" people. Obviously, we borrow from these disciplines to form important aspects of safety technology and supervisory training and skill. But supervisory management must re-

main amateurs in this area. They are presumed to have expertise in the area of supervisory-management practices. Why seek solutions in an area that baffles the experts? Why not also seek cause and corrective action in their own area of expertise, that of supervisory management practices.

Mate Two Sets of Ideas

To seek cause and corrective action in supervisory-management practices, we mate two sets of ideas. We mate the idea of "locate and define operational error" to the inbred thinking of the Heinrich format. The mating produces the principle that accidents and injuries as well as unsafe acts and conditions are all symptoms of operational error. Behind the unsafe scaffold, the unsafe act, the faulty tool, the defective machine or layout lie management practices. Behind any proximate cause (unsafe act and/or condition) ascribed to an accident lies management practices in policy, priorities, organization structure, decision-making, evaluation, control, and administration. Accident investigation seldom dwells in these areas.

In this modification of Heinrich, the input of safety technology and immediate correction are still achieved by identifying unsafe acts and conditions. We ask, "What unsafe act and/or condition," and receive a reply in terms of safety technology. But we expose operational error by asking two further questions: "Why the unsafe act and/or condition was permitted" and "Whether supervisory-management had the safety knowledge to prevent the accident." The what-why-whether process may be diagrammed as follows:



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The "whether" question asks whether the laws, codes, and standards applicable to the circumstances were known. Whether the safety director knew them. Whether the hazard had been identified by foresight. Whether the books, pamphlets, pass-outs, and knowledge needed were available. Whether the supervisor knew them. In short, did the organization possess knowledge of the safety technology available?

The "why" question asks why knowledge was not effectively sought or why it was not effectively applied. The question exposes operational error in the area of management policy, confusion in goals, staffing, housekeeping, responsibility, use of authority, line and staff relationships, accountability, rules, initiative, and much more. These deficiencies in supervision and management combine to produce an accident rather rarely. Their correction improves the daily operation as notably as they prevent accidents.

Purpose To Create a Rationale

The purpose of all of the above is merely to create a rationale upon which to teach the management of the safety function. We now can summarize the above and introduce a series of statements or principles to guide further thought and study, the aim being to assist the safety director to function as a manager.

Accidents and injuries (and unsafe acts and conditions) are symptoms of operational error. This principle summarizes the foregoing, since the function of safety is to locate and define those operational errors which result in accidents and injuries.

Every accident is the result of operational errors together with some combination of unsafe acts and conditions. This is the familiar idea of multiple causation with emphasis on seeking cause and correction in the acts of supervision and management. Rare is the accident which was unpredictable to safety technology. The hazard and its control were known, and usually clearly set forth in the literature of safety. Hindsight nearly always indicates how it could have been prevented, and yet it wasn't. Factors of policy, priorities, pressures, conflicting goals, rule enforcement, procedure, authority, and accountability relationships—factors of supervision and management stymied effective implementation of safety technology.

By this principle we also avoid the useless hassle over whether most accidents result from unsafe acts or unsafe conditions. The dying myth that 88% of accidents result from unsafe acts is startlingly alive in the ranks of supervision and management, producing blame of persons but little improvement in supervision and management. Once again—"locate and define operational error"—integrate safety into the prevention of unexpected and undesired results. When operational error is corrected to prevent accidents, injuries, and unsafe acts and conditions, we at the same time achieve supervisory-management improvements that help to prevent the daily incidents

of waste, inefficiency, rework, "ball-ups," and "snafus." The same operational errors, combining in ever-changing and often improbable ways, produce the daily load of unexpected and undesired results, including relatively rare accidents and injuries.

Safety management encompasses more than injury prevention. Perception of the scope of safety is too narrow when property damage accidents go unrecorded until they produce an injury. Or when adjunct motor vehicle operations are touched hardly at all, or its opposite, when fleet safety directors need reminding that injuries on the dock and in the shop fall under their purview.

Fire safety in many operations is clearly defined as part of safety. In others it clearly is assigned to a fire marshal or to security, but in a huge middle block it is clearly assigned to nobody. Exclusive concern with injury prevention leaves many areas of responsibility undefined, blinds us to opportunities to improve our organization, and creates the very circumstances in which people get hurt or killed.

Scope Needs Consideration in Every Organization

The scope of safety management needs consideration in every organization. Does it include fire, or security, or product safety, or insurance claims administration, or public liability exposures, or motor vehicle safety? Safety combines well with certain other functions; and the needs, priorities, and structure of organizations differ. My purpose is not to define the precise scope of safety management nor to insist that it should be the same in every operation. My purpose is to observe the blinders created by exclusive focus on injury prevention.

The blinders can be removed by reverting to the definition of the safety function—to locate and define operational error that produces the symptom we call an accident or injury. With that definition the organizational structure can be surveyed, areas of defined and undefined responsibilities can be exposed, staff and line authorities can be clarified, and the scope of the safety function can be defined in accord with the needs and priorities of the organization.

Safety performance reflects the will and the competence of line management. However worded, and whatever the semantic difficulties created by any given set of words, this principle enunciates the most fundamental tenet of safety, usually worded to the effect that safety is a line function.

A classroom exercise in one company illustrates the concept. The group had been carefully selected to include all echelons of management. There sat the vice president of a plant or a product line with his superintendents, managers, supervisors, foremen, and front line leaders, a vertical slice of the whole line organization. After suitable preliminaries, they were asked to list all the things they saw "out there" to correct in order to prevent accidents.

Some of what they saw was vague and abstract,



"The task of safety management is to see that the line organization at any echelon receives direction from line superiors to achieve safety objectives plus the input of safety technology." Photo courtesy of The Richardson Company, Beacon, New York.

but they also recorded specifics—the leaky valve under pressure, the strewn hoses, the walkway with no railing, the slippery floors, the tag-out on machines that required lock-out, tag-outs left in place after repair was completed, rules ignored and invoked only when an injury actually occurred. They saw quite a bit.

Then they were asked, "Why haven't you corrected these things? At some level you have command authority. Why haven't you issued the orders necessary to correct these things? What are you waiting for?" The ensuing discussion, of course, corrected the idea that safety is something done by the safety director, and exposed the real confusions, the conflicting pressures, the real limitations on their command authority, and the patterns by which they received praise, blame, and reward. The resolution of those real obstacles goes far to indicate the role of the safety director as a manager.

Heinrich's Axiom Can Be Misleading

Heinrich's axiom that "the supervisor or foreman is the key man in industrial accident prevention" can be misleading. What the supervisor does about safety depends on what his boss wants him to do, not on the admonitions of the safety director. His rewards come from his boss, not the safety director, and so on up the chain of command to the chief executive.

Emphasis on the key man creates the idea that safety is somehow achieved by lower echelons with the help of an occasional "tut tut" from the rarified levels of upper management. The key-man idea even causes the inexperienced safety director to feel that his job is to scurry to the lowest echelon of front-line supervision, and with that precarious leverage seek to move the whole organization. What the front-line supervisor will do, indeed what he can do, is set for

him by management direction. The task of safety management is to see that the line organization at any echelon receives direction from line superiors to achieve safety objectives (plus the input of safety technology).

Management direction of loss control is just that, direction by management in accord with the mission of the organization, utilizing safety expertise to help achieve the mission of the line structure. If the safety director has to plead for cooperation, the shoe is on the wrong foot; management direction is ineffectual. Also, it would appear, safety has been misconceived as a preaching chore, an operational error to which the safety director may contribute by failing to exercise his role as a manager.

Command authority to achieve safety objectives resides in the line structure. Safety management is a staff function—guiding, planning, counseling, assisting the line to achieve its mission. The concept begins as an advisory function with no command authority; though, as we shall see, a staff function can be invested with command authority.

The term, “command” authority, is here used to designate line authority. It’s a brisk term, usually avoided in business; but it does precisely indicate superior-subordinate relationship. To the extent that a staff function is invested with command authority, it can intervene into the operations of the line. Basically, safety is a staff function guiding, planning, and assisting with command authority circumscribed by policy and practice. The command authority to achieve safety objectives resides in the line.

Staff-Line Authority Relationships

Since safety is a staff function, it follows that study of the queasy subject of staff-line authority relationships augments effective safety management. Texts have been written on it. Any management text contains a chapter on staff-line relationships. None ever mentions safety or illustrates with safety examples. Perhaps that’s why safety so frequently is reduced to pleading for cooperation. The chapter in Koontz and O’Donnell is perhaps richest in implication and most precise, though there are easier expositions for purposes of safety management.

The needs of the organization should determine whether the safety function should be invested with command authority. The managerial question should be: “What command authority is needed by the safety function to achieve the mission of the line organization, and what command authority presently exists in practice?” The clarity of thinking posed by those questions kills many a stirring bull session about management support or the personality attributes of the safety director.

Safety management is powered by policy, not support and cooperation. Policy is the management tool which asserts direction and resolves competing and conflicting goals and priorities. Safety policy should

not be a species of poetry asserting noble aspiration. Clarification of safety policy should be one of the primary aims of safety management.

What is *policy* as contrasted to procedure, methods, rules, and instruction—all of which are presented in manuals and handbooks and often referred to as policy. Perhaps much fruitless discussion of dictionary definitions can be avoided by giving the word, “policy,” a pragmatic definition: Policy is the voice of the big boss. So defined, the safety function should know which boss has that voice, and what they want that voice to say.

Try a brain-cudgeling exercise to open the doors of perception. Write precisely-worded statements of what safety policy is thought to be. Begin with whatever written policy exists. Consider what may exist as unwritten policy. Assess practices and procedures as reflections of policy. Whatever exists in fact and practice for good or bad can be reduced to statements of de facto policy.

Must Understand His Organization

The safety manager must understand his organization—its needs, its conflicts, its goals, its resources—so that he can define what he wants that big voice to say. Safety’s problems in achieving support and cooperation should be reduced to carefully-carved statements of written policy and submitted for acceptance, rejection, or modification. Top-echelon line executives should participate in the process, for they must operate under the policy and lend command authority to its implementation. Safety is ill-served by treating it solely as a humanitarian impulse, welling up from below, and pleading for support. Safety, rather, is a function to be managed with skillful application of the requisite management tools and principles. In this case, that means that a proper understanding of management literature on policy becomes part of effective safety management.

The voice of the safety director is the voice of his boss. The voice of any staff man is the voice of his boss. How far that voice reaches, whether it speaks for him, whether it influences necessary centers of line authority, whether his boss is himself line or staff—all this must be considered in determining what niche safety management occupies in the company organization. In a smaller organization, safety usually reports to the chief executive, whose voice obviously can reach the whole organization. In larger organizations, this simple solution is not always feasible.

Safety can be found reporting to line operations, to maintenance, to engineering, to legal, to the insurance manager, to the personnel manager, to industrial relations, even into the training department. Where should it be in order to effectively manage the safety function? Part of the answer lies in the principle of similar groupings, and part lies in the goals of the organization which should be reflected in the orga-

nization structure. The question is easier asked than answered; and the answer should be unique to each organization, and the niche occupied does make a difference. The differences can be assessed by remembering that the voice of the safety director is the voice of his boss. Weaver and Petersen have pursued the principle further, and Simonds and Grimaldi have touched on location in the organization structure.

Accountability should be fixed near the point of control. The point of control lies in the line organization. Therefore, safety management must devise procedures to fix accountability at the point of control. This means something counted or measured with sufficient reliability and validity that line management accepts it for appraisal, praise, blame, correction, and reward. Correction of supervisory safety performance (with suitable input of safety expertise) should be the task of immediate superiors at every echelon, *because it matters to them*, because they also are being held accountable by the same procedures.

"Tenuous, Variant, Insensitive, Unreliable"

Typical safety measurements, in the words of Tarrants, prove to be "tenuous, variant, insensitive, and unreliable." Admitting the real difficulties, the more important point is that safety technology has failed to cope with the challenge posed by the management principle. Instead, safety literature is filled with motivation and incentive gimmicks (admirable in themselves), expositions of management role and responsibility, and topics on how to get support and cooperation.

Petersen has published an item recognizing the principle and has proposed that procedures to fix accountability be developed in two pathways. One pathway evaluates activities—whether the line organization purposefully implements those activities, lock-outs, inspections, orientations, coaching, pre-planning, reporting, etc., deemed necessary and under the command authority of the line. The development of procedures to fix accountability for activities (see Diekemper & Spartz in references) would seem to pose no insurmountable obstacle. The other pathway would fix accountability for results—whether the activities pursued actually control injuries and costs, with accountability so fixed that results show up in budgets, profit and loss statements, appraisals, and recognition for successful supervisory-management performance. This is where typical data proves variant, tenuous, and unreliable.

Nonetheless, safety literature contains many isolated tools that could be bent to this purpose, but they have not been harnessed to the management principle and expounded as a management tool. They seem largely to have been conceived as research projects or as arguments to gain support. The task is to shape them into on-going control data for the use of line management, not the safety director. Petersen

has contributed, also, a hypothetical method to achieve this purpose, but lack of method is less significant than lack of managerial principle. Feasible methods within the administrative resources of any organization do exist and are utilized effectively by some organizations. Their wider use depends on shrewd management of the safety function, and the development of a body of literature beyond safety technology dealing with the techniques of safety management.

Mission-Oriented Line Management

Line management by necessity is mission-oriented. The mission should include due regard for the welfare of people; but the primary mission is economic survival. The resources of any organization are limited; and time, money, and effort are expended according to apparent importance. Thus, the tasks of safety consciously or unconsciously assume a priority of importance, including humanitarian ethics and morality. Humanitarian aspirations are best achieved by mission-oriented safety management. The command authority of line management will be devoted to the tasks of safety to the degree that safety management serves their mission. That is why procedures to fix accountability are so important, so that safety performance at each echelon can be measured as it contributes to the mission.

In summary, safety management improves the whole process of supervisory-management, measuring its effects in terms of goals defined to serve the mission of the organization. But goal setting is another topic for another day. Organizational improvement is not a counsel of perfection. Organizations are composed of fallible people and will always be imperfect. But it's more feasible to improve organizations than to improve people.

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